Heating Piping & Air Conditioning

JULY 1957

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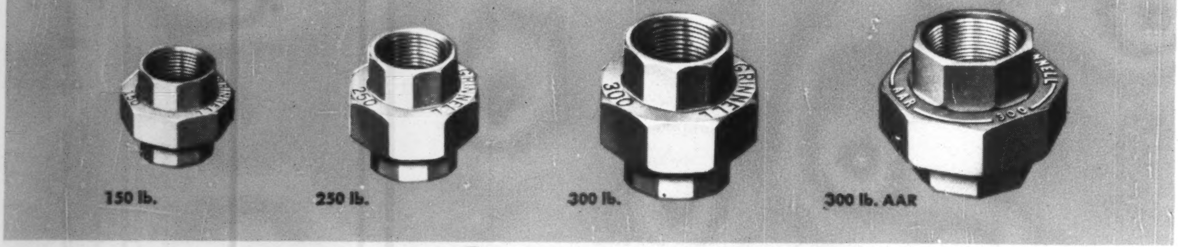
INDUSTRIAL • COMMERCIAL • INSTITUTIONAL • PUBLIC BUILDINGS

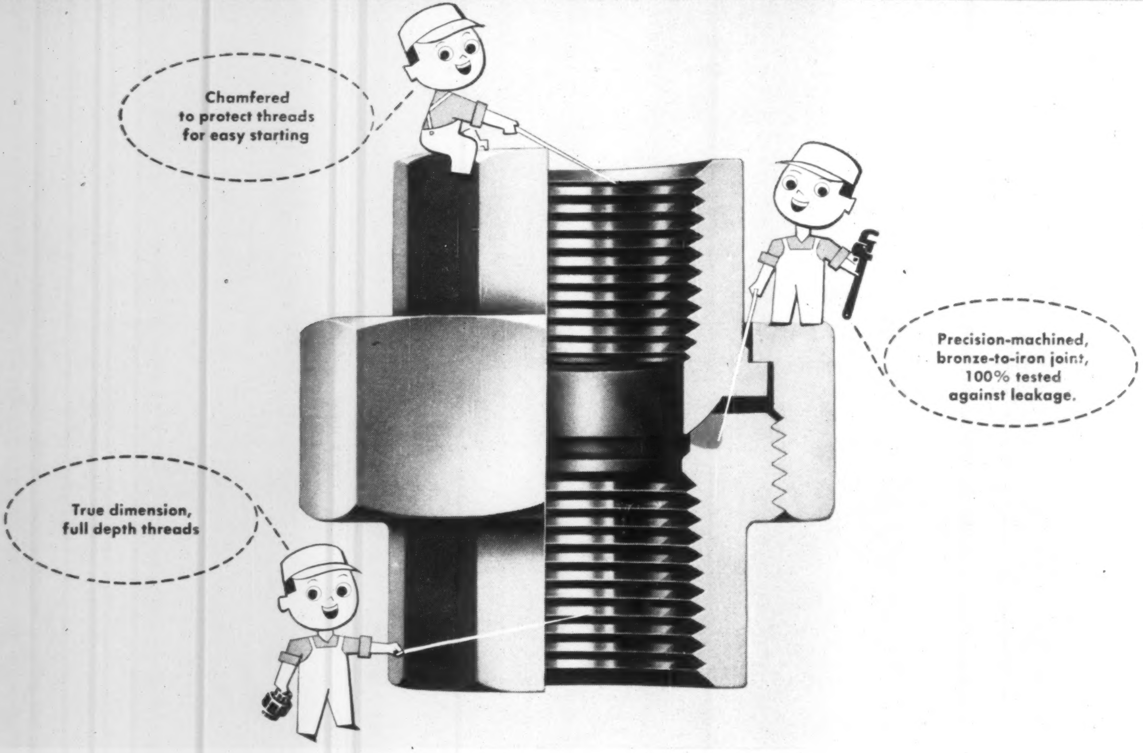
American Society of Heating and Air-Conditioning Engineers Journal Section—page 143

River Packet's Steam Plant Heats Shore Buildings... 99

Save time on the job . . . avoid customer gripes after the job, with

GRINNELL bronze-to-iron UNIONS


150 lb.
250 lb.
300 lb.
300 lb. AAR


Chamfered to protect threads for easy starting
Precision-machined, bronze-to-iron joint, 100% tested against leakage.
True dimension, full depth threads

In the Grinnell Union, there's strength . . . *rugged, built-in strength!* A superior grade of malleable iron is used in Grinnell bronze-to-iron unions — followed by careful manufacture and frequent quality checks. The end result is the high quality Grinnell Union which must pass the final air pressure inspection test under liquid before it is accepted. No wonder Grinnell bronze-to-iron unions are a standard of comparison for the industry.

Quality Grinnell bronze-to-iron unions feature:

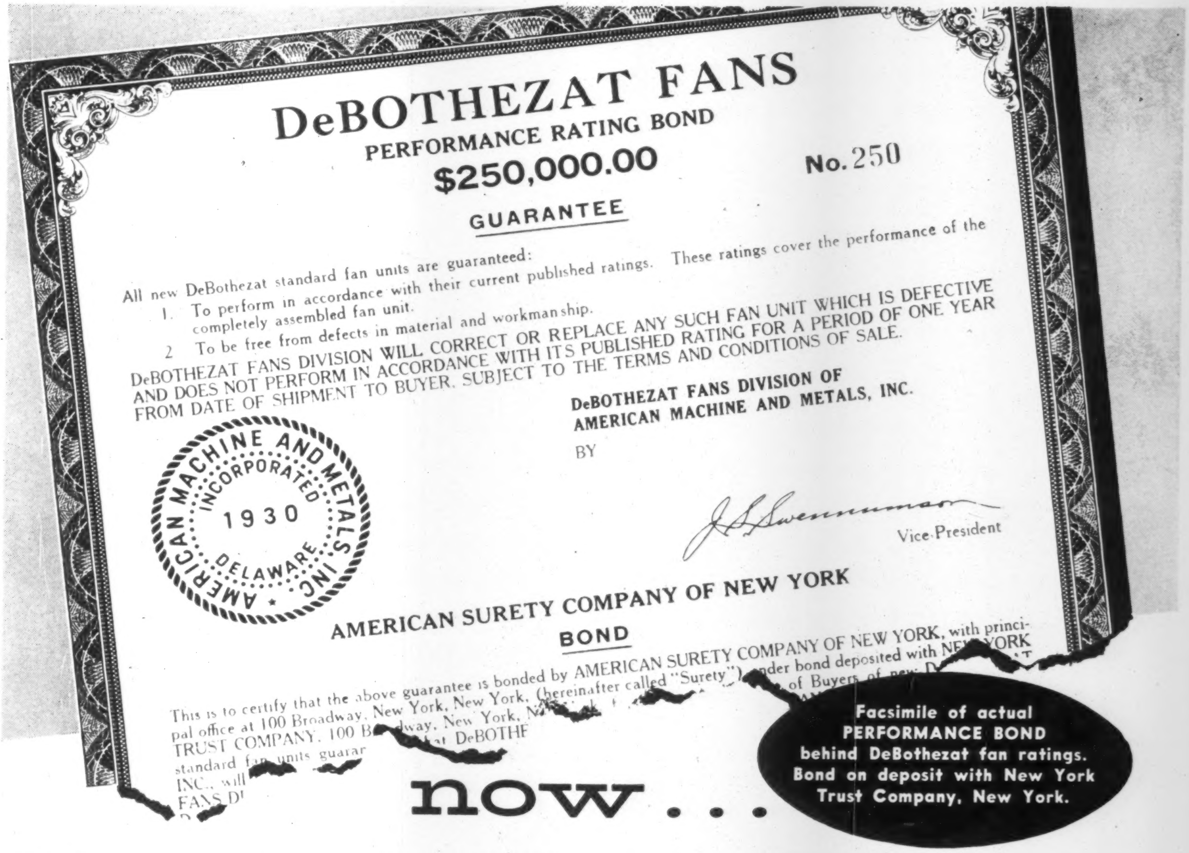
- Precision-machined, bronze-to-iron joints for a positive, leak-proof connection
- 100% tested with air under liquid
- Bronze ring inserts of improved design
- True dimension, full depth threads
- Chamfered to protect threads for easy starting

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • **Coast-to-Coast Network of Branch Warehouses and Distributors**

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



DeBOTHEZAT FANS
PERFORMANCE RATING BOND
$250,000.00 No. 250

GUARANTEE

All new DeBothezat standard fan units are guaranteed:
1. To perform in accordance with their current published ratings. These ratings cover the performance of the completely assembled fan unit.
2. To be free from defects in material and workmanship.

DeBOTHEZAT FANS DIVISION WILL CORRECT OR REPLACE ANY SUCH FAN UNIT WHICH IS DEFECTIVE AND DOES NOT PERFORM IN ACCORDANCE WITH ITS PUBLISHED RATING FOR A PERIOD OF ONE YEAR FROM DATE OF SHIPMENT TO BUYER, SUBJECT TO THE TERMS AND CONDITIONS OF SALE.

DeBOTHEZAT FANS DIVISION OF
AMERICAN MACHINE AND METALS, INC.
BY

Vice-President

1930

AMERICAN SURETY COMPANY OF NEW YORK
BOND

This is to certify that the above guarantee is bonded by AMERICAN SURETY COMPANY OF NEW YORK, with principal office at 100 Broadway, New York, New York, (hereinafter called "Surety") under bond deposited with NEW YORK TRUST COMPANY, 100 Broadway, New York, N ... of Buyers of new D ... DeBOTHE ... standard fan units guarar ... INC., will ... FANS DI

Facsimile of actual PERFORMANCE BOND behind DeBothezat fan ratings. Bond on deposit with New York Trust Company, New York.

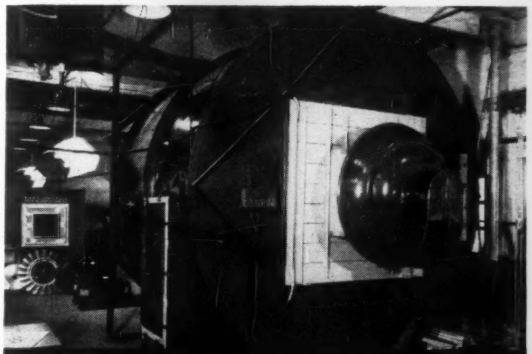
now . . .
Bonded Fan Ratings

You can depend upon all DeBothezat fan ratings because they are *bonded*. When you select a DeBothezat fan by its published rating, do so with confidence. No guesswork — no allowance to be on the safe side.

All DeBothezat fan performance ratings are *bonded* by the American Surety Company and this bond is on deposit with New York Trust Company, New York.

This is your positive assurance that a DeBothezat rating is what the *complete* fan unit actually puts out.

Remember, you can depend on DeBothezat fan ratings because they're BONDED.



Partial view of DeBothezat's own advanced testing facilities. Accurate wind tunnel tests are made here in accordance with the appropriate NAFM plate . . . conform to U. S. Dept. of Commerce Standard 178-51.

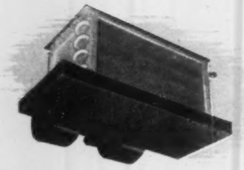
Copyright 1957

De Bothezat FANS
A DIVISION OF
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS
IN CANADA: Represented by DOUGLAS ENGINEERING CO., Ltd., Toronto • Montreal

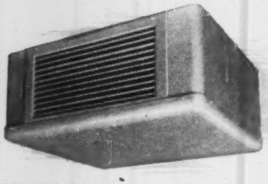
Here's Why

Dunham-Bush 'CR' Year 'Round Room Air Conditioners provide MAXIMUM FLEXIBILITY

'CRV' Console Unit



'CRH' Basic Unit



'CRH' With Cabinet

'CRV' Basic Unit

FLEXIBILITY... in choice of Construction

That's the keynote of the Dunham-Bush line of 'CR' year 'round room air conditioners. Typical of the variations available: cabinet or recessed models; vertical or horizontal models; combination water cooling and heating coils; combination direct expansion and steam coils; three control kits.

FLEXIBILITY... in Selection

Model	CFM Normal Speed	Water Coil Capacities		Inner-Fin Direct Expansion Combination Steam Coil	
		Cooling BTU/hr	Heating BTU/hr	Cooling BTU/hr	Heating BTU/hr
CRV-220 & CRH-220	220	5,600	18,300	6,400	15,300
CRV-330 & CRH-330	330	8,400	25,400	9,800	21,500
CRV-450 & CRH-450	450	13,200	35,300	14,900	28,000
CRV-600 & CRH-600	600	21,000	55,000	23,200	45,300

Cooling capacities (total heat) based on entering air 80° DB, 67° WB, 45° water (or 40° suction).

Heating capacities based on entering air 60°, 2 psig steam.

FLEXIBILITY... in Installation

Vertical models with cabinet can be exposed or semi-recessed, basic units completely recessed. Horizontal units with cabinet can be ceiling suspended in conditioned space; basic units can be utilized for unexposed installation.

Contact your nearest DUNHAM-BUSH Sales Engineer for complete specifications or write for 'CR' catalog.

Dunham-Bush, Inc.

WEST HARTFORD 10 • CONNECTICUT • U. S. A.

DUNHAM-BUSH

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AIR CONDITIONING • REFRIGERATION • HEATING • PRODUCTS AND ACCESSORIES

Heating Piping & Air Conditioning

Vol. 29 No. 7

(With which is merged the Aerologist)

DESIGN, INSTALLATION, OPERATION
AND MAINTENANCE IN
INDUSTRIAL, COMMERCIAL, INSTITUTIONAL
AND PUBLIC BUILDINGS

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One in a series.

How to Select a Steam Trap Big Enough for the Job

Adequate capacity safety factors are essential to operating efficiency

As promised to you in a previous Armstrong trap advertisement in this publication, here is some helpful information on steam trap safety factors.

First, the definition. A trap safety factor is simply the ratio between actual continuous discharge capacity of the trap and normal condensate load. If the load is 500 lb/hr and the trap actually will discharge at the rate of 1000 lb/hr, the safety factor is said to be 2 to 1, and so on.

Why a Safety Factor?

You are not going to get maximum heat transfer efficiency from any steam heated unit unless your traps are sized with a generous excess of capacity over the normal condensate load.

Remember that trap capacity is given in terms of *continuous* discharge of condensate at a given pressure differential. If you don't employ an adequate safety factor, you make no provision for these requirements or conditions:

1. ***Venting of gas,*** O_2 and CO_2, would be impossible if a trap should discharge a full stream of water continuously.

2. ***Peak loads*** would back up condensate in the line or unit if the trap were sized for average load.

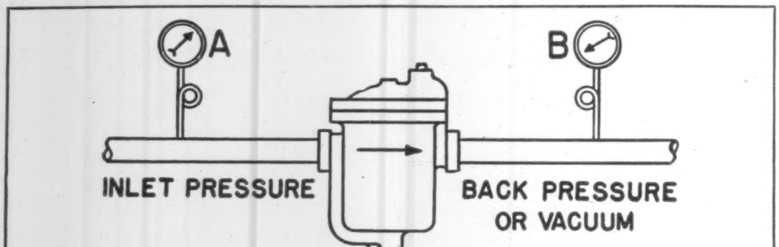
3. ***Reduction in pressure differential*** across the trap orifice would reduce capacity below requirements. If steam pressure drops below normal, trap capacity is lowered more than condensing rate. An increase in back pressure for any reason cuts trap capacity. And, pressure differentials often drop substantially during warming-up periods.

4. ***"Group" trapping.*** Very occasionally it is impractical to use an individual trap on each coil or condensing unit. Here, a generously oversized trap helps prevent backup of condensate or air from one unit to another. The frequent opening of a big trap valve "pumps" non-condensibles and condensate to the drain header.

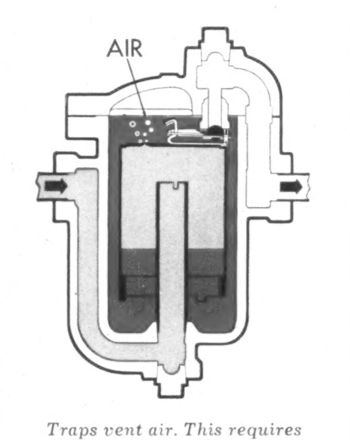
What Safety Factor?

Fortunately, it isn't necessary to calculate safety factors. Experience is the best guide and the benefit of experience with tens of thousands of successful installations is available to you. The following table is taken from the Armstrong Steam Trap Book.

Page	Equipment Drained	Safety Factors
24	Purifiers and Separators	2 or 3 to 1
25	Steam Mains or Headers	2 or 3 to 1
26	Steam Heating Pipes...	2 to 1 up to 6 to 1
29	Unit Heaters................	3 to 1
30	Submerged Coils..........	2, 3 or 4 to 1
32	Cylinder Dryers..........	4 to 1 up to 10 to 1



Pressure differential affects trap capacity. If "B" is back pressure, subtract from "A"; if "B" is vacuum, add to "A". Safety factors compensate for drops in pressure differential.



Traps vent air. This requires a trap capacity safety factor.

The page numbers listed contain completely reliable data for any trapping job.

CAUTION. The safety factors recommended in The Armstrong Steam Trap Book will have to be increased by an unknown factor for trap capacity ratings based on cold water tests, orifice tests or slide rule calculations. Armstrong trap steam temperature condensate capacity ratings are based on actual operating conditions which take into account such capacity-reducing factors as pipe friction and the choking effect of flash steam.

If you'd like to have a copy of the 44-page Steam Trap Book, just call your local Armstrong Representative, or write the factory. There is no obligation.

Armstrong Machine Works
8747 Maple Street
Three Rivers, Michigan

ARMSTRONG
STEAM TRAPS

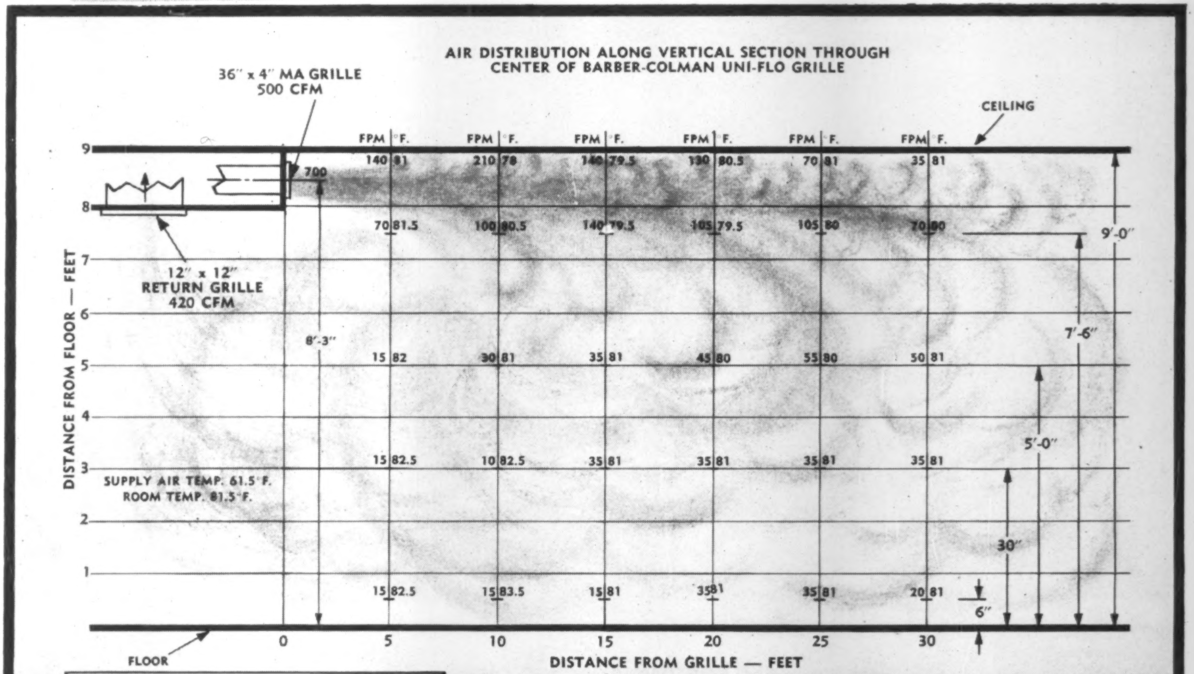
THE MARK OF QUALITY

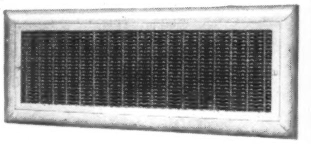
BARBER COLMAN

Uni-Flo

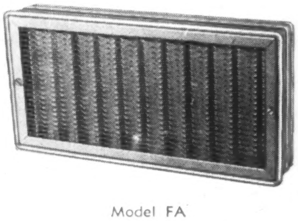
ENGINEERED AIR DISTRIBUTION

predict and deliver air patterns like this...





Model MA
Double-Deflection Grille



Model FA
Double-Deflection Grille

Precision distribution of conditioned air from sidewall grilles is no problem when you specify Uni-Flo. Uni-Flo Grilles are true sidewall diffusers, designed to give adjustable air pattern and rapid diffusion without air stream drop or excessive air motion. Laboratory-tested, field-proved performance data permit the engineer to create required conditions without guessing. Variety of types available. For complete details, call your nearby Barber-Colman Field Office, or write . . .

BARBER-COLMAN COMPANY

DEPT. S, 1101 ROCK STREET, ROCKFORD, ILLINOIS, U. S. A.
Field Offices in principal cities

THE MARK OF QUALITY

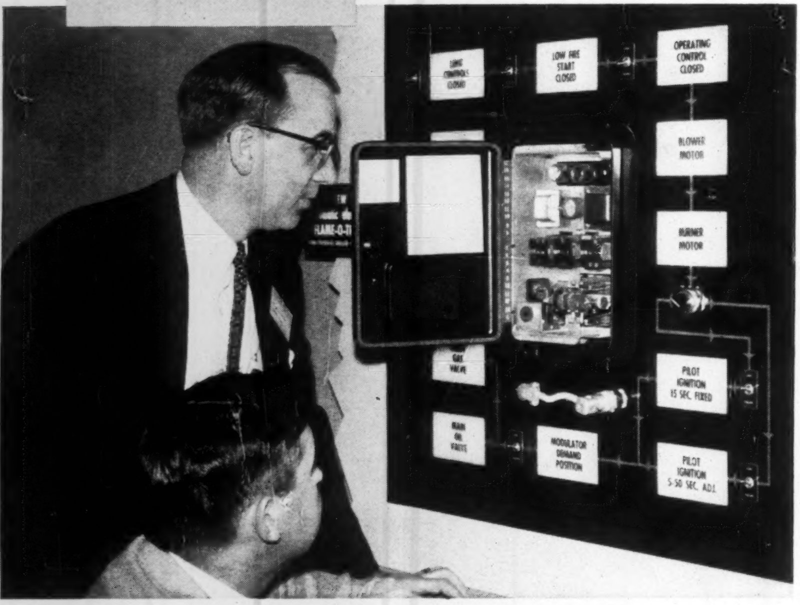
BARBER
COLMAN

Wheelco Instruments

Manual or automatic

Wheelco Flame-otrols

for flame-failure protection


LIMIT CONTROLS CLOSED
LOW FIRE START CLOSED
OPERATING CONTROL CLOSED
BLOWER MOTOR
BURNER MOTOR
GAS VALVE
PILOT IGNITION 15 SEC. FIXED
MAIN OIL VALVE
MODULATOR DEMAND POSITION
PILOT IGNITION 5-50 SEC. ADJ.

Features of the Wheelco super-duty automatic Flame-otrols are visible at a glance in this special display installation. Note ready accessibility of principal components.

←

Automatic Operation

Sequence timing for oil- or gas-fired burner or boiler application includes: purging, warm-up proving, pilot proving, low-fire stabilization, ignition timing, and post purging. Terminal connections for directly handling a flame-failure alarm and a proportioning-type control motor are also included. Model 1474 uses flame-rods and emissive-type photo cells as sensing elements, while Model 1574 uses lead-sulphide cells as sensing units.

FLAMEOTROL

Manual Starting

Once the oil- or gas-fired furnace, oven, etc. is started, the Flame-otrol shown here takes over the problem of flame supervision. After fuel ignition, the manual model provides for complete burner shutdown protection immediately following flame outage or high-limit "off" switching. Flexible circuit design makes possible use of various auxiliary equipment such as push-button starting, external timers for purging or timed ignition trial. Both "CR" systems using flame-rods and "IR" systems using lead-sulphide sensing cells are available.

Addition of super-duty automatic models for package boiler installations rounds out complete line of combustion safeguards for gas, oil, or combination burners.

Whatever the combustion safeguard requirements on furnaces, boilers, kilns, dryers, and similar applications — there's a Wheelco Flame-otrol to provide superior performance and unmatched dependability. The same sure operation and simplified maintenance that has characterized the manually or semi-automatically started models is designed into the new super-duty Flame-otrols for package boiler operations.

TWO BASIC SYSTEMS

Basically, there are two control systems available for Flame-otrol operations: Conductivity-Rectification "CR" system and Infra-Red "IR" system. A lead-sulphide cell is used as a sensing element in the "IR" system; flame-rods and emissive-type photo cells are sensing elements in the "CR" system.

Both flame "pick-up" methods are available in automatic or manually started models. Compact, plug-in design is incorporated in all models, offers maximum accessibility for adjustment, examination, and repair. The chassis are held in position for normal operation by captive latches or a retaining screw with the exclusive Wheelco terminal strip guaranteeing uniform contact pressure while permitting easy removal.

SIMPLIFIED MAINTENANCE

Convenient checking strips simplify trouble-shooting and normal maintenance — require only the use of standard instruments for checking circuits and voltages. Because standard electronic tubes are used throughout, inventory requirements of spare parts are reduced appreciably. Replacements can be obtained readily at any electronic supply house.

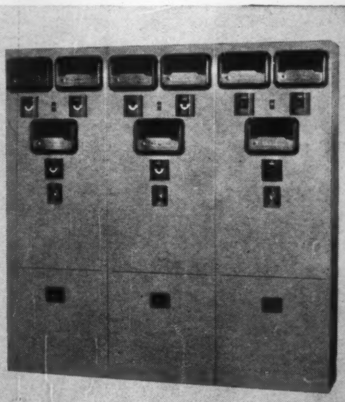
Heavy-duty construction of Wheelco Flame-otrol cabinets is an important factor in long, trouble-free operation of the units in all types of plant locations. The rugged, industrial-type steel cabinet with gasketed, dust-tight swing-out cover keeps out foreign matter that might interfere with operating efficiency. Applications requiring a flush-mounted unit are furnished with a cabinet that includes the necessary mounting flange.

Write for literature describing operations of either manual or automatic Flame-otrols today or, better still, have a Wheelco field engineer analyze your combustion safeguard needs. There's no obligation and you can be sure this analysis will be thorough with the recommendations specifically directed to the solution of your problems.

FLAMEOTROL

Control Centers

Where a method of housing a complete combustion safeguard system, including Flame-otrols, pilot lights, alarms, etc., is required or desirable, prewired Wheelco control centers reduce installation costs and time, plus providing an attractive centralized package. Flexibility to meet changing requirements is provided by use of removable sections. Bolt-down or hinged covers permit convenient servicing or system checking.



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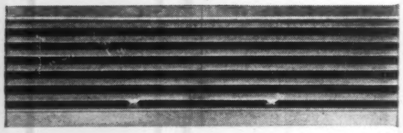
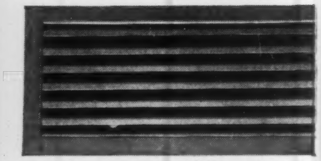
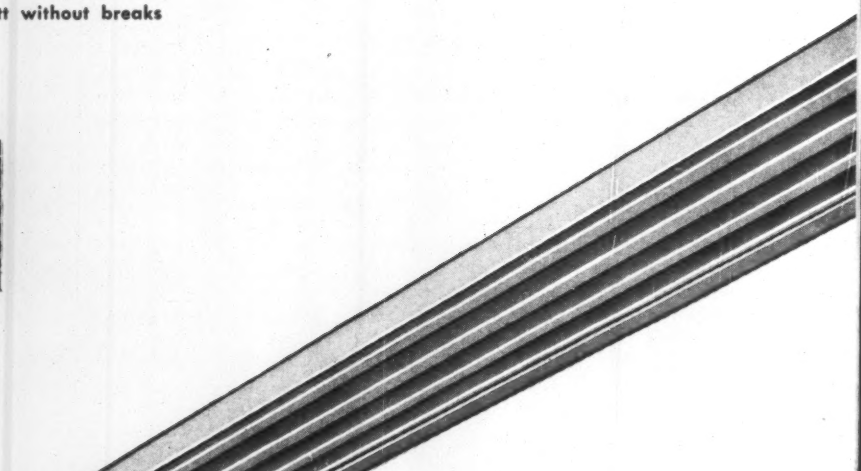
BARBER-COLMAN of CANADA, Ltd., Dept. S, Toronto and Montreal, Canada

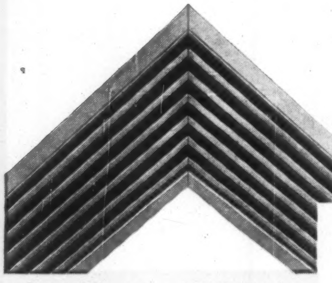


Sections butt without breaks

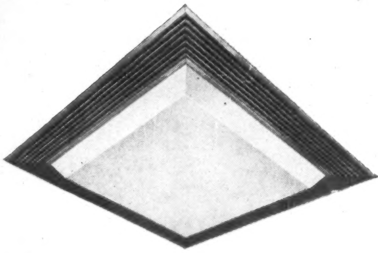


Trim, attractive end caps

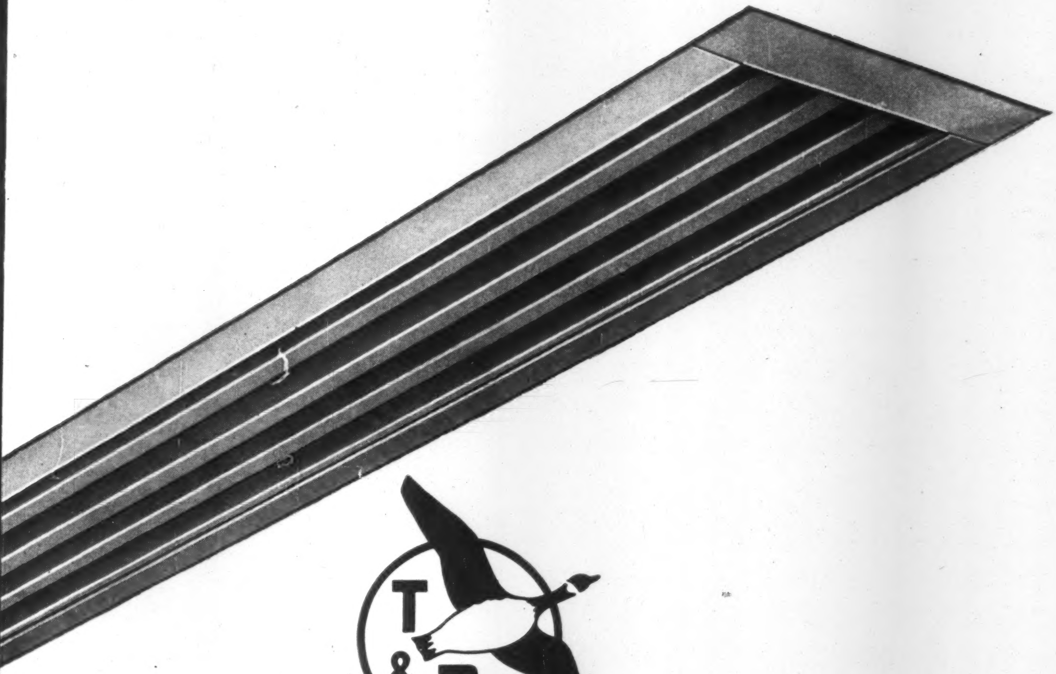




Mitered inside and outside corner sections . . .



. . . ideal for installation with square light fixtures



LINEAR DIFFUSERS

preserve the clean-line symmetry of modern architectural design

For installation on ceiling or sidewall, Tuttle & Bailey Linear Diffusers are designed to maintain the functional straightline beauty of modern architectural concepts. Particularly effective when installed in continuous runs, individual sections butt neatly without breaks, and mitered 90° inside and outside corners permit extension of the clean-line symmetry on perimeter applications. A unique yet simplified method of installation eliminates the need for screws in the margin of the diffuser. Units can also be furnished with a recessed plaster frame which means only the unbroken lines of the louvres are visible.

Tuttle & Bailey Linear Diffusers may be installed on either the supply or return portions of the system. They are available as one-way or two-way blow units in 18", 24", 30", 36", 48", 60" and 72" lengths.

TUTTLE & BAILEY

division of Allied Thermal Corp. New Britain, Connecticut

LINEAR DIFFUSERS

Today . . . write for Catalog No. 114.

Report No. 2 of a series

I used to be all wet until I found

Kathabar® systems eliminate wet floors, walls, equipment, and products!

Think what it would mean to you if you could eliminate condensation and its corrosion problems from plant processing and storage areas, and keep work spaces dry even when they're hosed down regularly for sanitation.

Maintenance savings alone would improve your profit picture for the year. Increased life of your structures and equipment would pay long-term dividends. Storage losses from condensation would be a thing of the past.

Such profits are immediately available to you in a Kathabar-engineered air conditioning system.

let's look at cases

This sampling of Kathabar installations will show you how effective and versatile a Kathabar system can be.

waterworks case

Pipe galleries in a huge waterworks are completely surrounded by water as cold as 40 F. A Kathabar system maintains the air at below the water dew point, year-round, and eliminates condensation. This system paid for itself in less than three years.

brewery case

In the new cellars of a large midwestern brewery, a Kathabar system is earning profits by elimating condensation. Washdowns are less frequent; dry cellars curb bacterial growth. As a bonus benefit, the Kathabar system kills 97% of all airborne micro-organisms. The brewmaster's temperature curve is followed precisely.

candy case

A candy manufacturer was plagued by condensation on the cooling slabs in his enrobing room. The moisture made his conveyor belt expand and jam. Chocolate and starch dust gummed up the belt and stopped production. A Kathabar system not only eliminated these problems, but increased production by 25%.

marine case

Kathabar systems in cargo ships and tankers provide anti-corrosion control, protection against cargo contamination, and ready gas freeing of all tanks. Kathabar systems quickly amortize themselves in maintenance savings, longer bulk-head life, better cargo protection, and faster turn-around.

other cases

Consulting engineers combine radiant panel cooling with Kathabar systems to dehumidify fresh air makeup. Colder water can be used in the panels, increasing efficiency without the danger of condensation.

Unitized Kathabar systems, using only electric power, dehumidify government storage caves. Completely portable, they are readily spotted to keep the dampest areas bone dry. Individual units avoid the fire hazard of a central system.

who uses Kathabar systems

Kathabar systems make profits out of air for these industries:

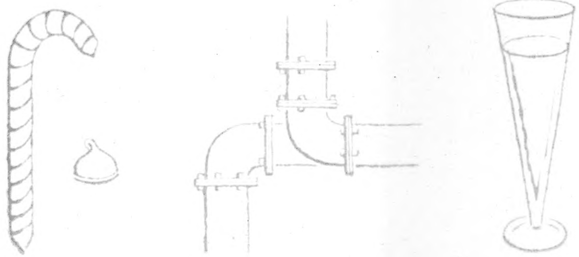
Atomic Energy
Breweries
Cake Mix
Candy
Cellophane
Cellulose
Cereals
Chemicals
Coffee
Comfort
Compressors
Cookies
Electronics
Explosives
Film
Foundries
Gelatin
Glass
Glue
Gum
Hospitals
Hotels
Lacquer
Lenses
Machining
Matches
Marine
Meat
Offices
Ordnance
Paper
Pharmaceuticals
Plastics
Printing
Rockets
Rubber
Shellac
Sugar
Sanitaryware
Testing
Textiles
Transformers
Transistors
Vacuum Tubes
Varnish
Waterworks
Wire
Yeast

how they use Kathabar systems

Many of these industries use Kathabar systems for eliminating condensation. Others use them to (1) obtain continuous air at sub-freezing dry bulb and dew points; (2) maintain spaces below 80 F and 55% RH; (3) deliver sterile air at specified dry bulb and dew point; and (4) improve drying processes.

send description of your problem

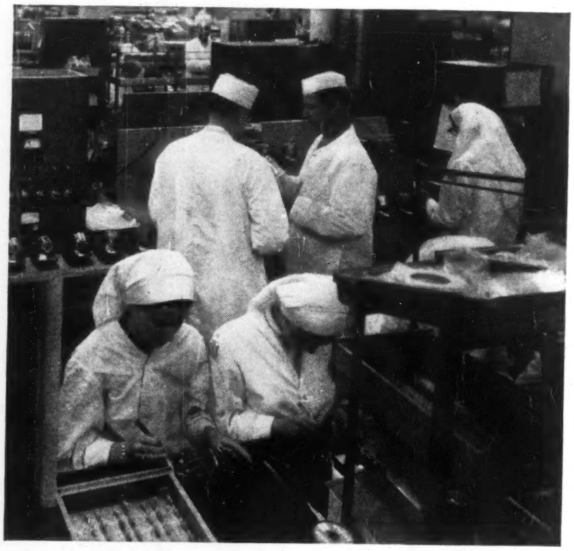
Air Conditioning and Drying Division
Surface Combustion Corporation
2384 Dorr Street Toledo 1, Ohio



Kathabar systems by **Surface®**

Who said dirt cheap?

Hospitals have a special need for air that's cleaned electronically. In operating rooms, nurseries, emergency rooms—in fact, throughout the hospital—it cuts down on airborne germs, giving important help in lowering the infection rate.



Many manufacturers of precision products find electronically cleaned air a near-essential to efficient production. It also eases maintenance problems caused by airborne dirt; and it keeps nuisance dirt off desks and files in office areas.

*New Honeywell Electronic Air Cleaner removes 6 times more costly dirt than mechanical filters**

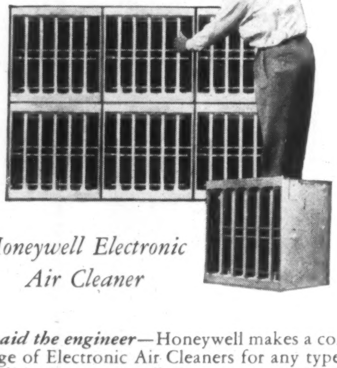
IN ADDITION to the cases shown above, most soiling of your client's work surfaces, walls, fixtures and merchandise is done by airborne particles less than 1/25,000 of an inch in size.

Particles much smaller than these—including the bacteria and viruses that cause many respiratory ills—can be removed by Honeywell's new Electronic Air Cleaner.

It is an impossible job for the mechanical type filter to remove oil smoke, fumes, tobacco smoke and much of the dust and fly ash that fall into this microscopic class of contaminants. And these are the ones with the greatest staining power.

The new Honeywell Air Cleaner's wide range of protection offers a scientific way to cut the high costs of cleaning, soiled merchandise, mechanical failures and absenteeism by trapping airborne dirt *before* it has a chance to steal your client's profits.

Your next job, whatever it is, can probably benefit from a Honeywell Electronic Air Cleaner. Specify it with confidence; the advantages more than pay for installation. For complete information, call your local Honeywell office or write Minneapolis-Honeywell, Dept. HA-7-226, Minneapolis 8, Minnesota.



Honeywell Electronic Air Cleaner

To aid the engineer—Honeywell makes a complete range of Electronic Air Cleaners for any type of air conditioning or ventilating system. Number of cells is determined by amount of air handled by the system. *Module construction* makes installing and servicing easy. Sales and service aid available in 112 Honeywell offices across the nation.

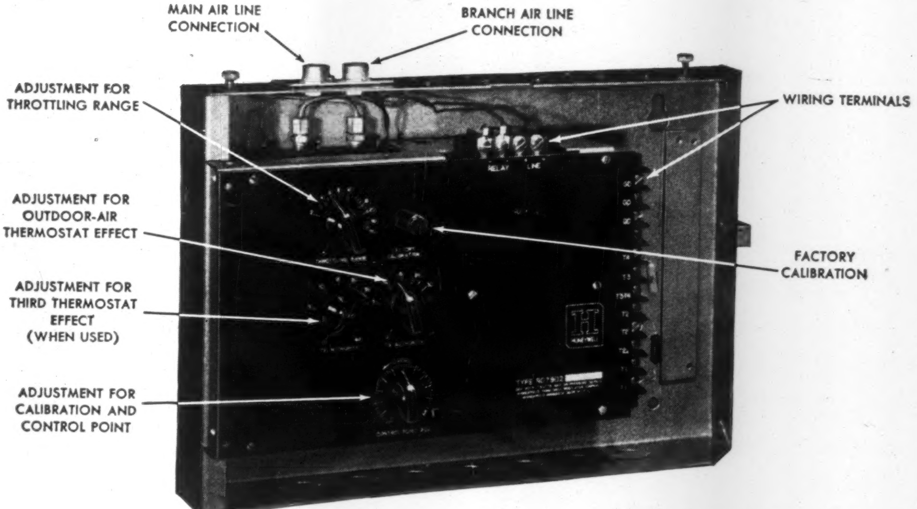
Honeywell

H HONEYWELL First in Controls

**According to the National Bureau of Standards tests, electronic air cleaners remove at least 90% of the dirt particles causing the greatest staining, while ordinary mechanical filters remove only about 15%.*

Easier way to do a better control job

Honeywell's New Electronic-Pneumatic Relay


MAIN AIR LINE CONNECTION
BRANCH AIR LINE CONNECTION
ADJUSTMENT FOR THROTTLING RANGE
WIRING TERMINALS
ADJUSTMENT FOR OUTDOOR-AIR THERMOSTAT EFFECT
FACTORY CALIBRATION
ADJUSTMENT FOR THIRD THERMOSTAT EFFECT (WHEN USED)
ADJUSTMENT FOR CALIBRATION AND CONTROL POINT

All Adjustments at One Convenient Location

MEET THE RO7902, Honeywell's new electronic-pneumatic relay.

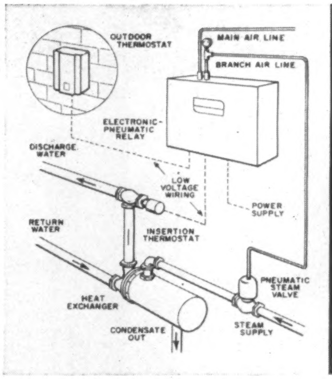
Together with its electronic thermostats it puts out a control air pressure—based on an electronic signal—for use with a standard pneumatic system.

This means that with only minor changes to your standard layouts the new RO7902 brings to your master-submaster jobs the speed and stability, the convenience and simplicity, of electronics. Here's how you benefit:

1. *All calibration and set-up is carried out right at the relay—no traveling from one thermostat to another.*
2. *Fewer adjustments are needed to put each system into operation.*
3. *Adjustments are made merely by setting a knob instead of probing with a screwdriver into hard-to-get-at places.*
4. *It's as easy to make changes later, or to troubleshoot, as it is to make the initial set-up.*

All these benefits stem from the simplicity of the electronic thermostat. Entirely non-mechanical, it has no moving parts—no bellows, linkages or pilot-valves; its heart is a coil of fine wire in which changes in temperature induce changes in resistance. These changes, reaching the RO7902, are converted from minute low-voltage signals to changes in air pressure which activate the operator.

You'll want to know more about this easier, simpler way to get better control. For details about the new RO7902 relay, call your local Honeywell office. Or write to Minneapolis-Honeywell, Dept. HA-7-226, Minneapolis 8, Minnesota.


OUTDOOR THERMOSTAT
MAIN AIR LINE
BRANCH AIR LINE
ELECTRONIC-PNEUMATIC RELAY
DISCHARGE WATER
LOW VOLTAGE WIRING
POWER SUPPLY
RETURN WATER
INSERTION THERMOSTAT
PNEUMATIC STEAM VALVE
HEAT EXCHANGER
STEAM SUPPLY
CONDENSATE OUT

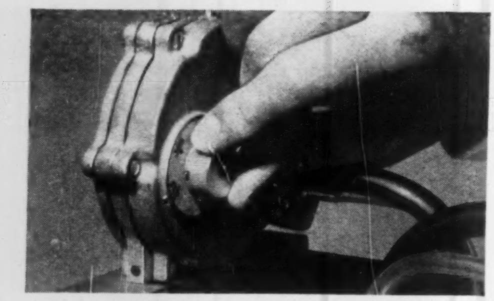
Simple, centralized hook-up

The diagram above shows how the basic control hook-up utilizing Honeywell's new Electronic-Pneumatic Relay parallels conventional master-submaster system. Big difference is convenience of centralized set-up, checking and adjustment.

All system adjustments made at panel

All settings and adjustments are made at the RO7902 relay. It can be mounted any distance from the thermostats, at the most convenient spot. Simple, standard, low-voltage wiring is used. Shielding is not required.

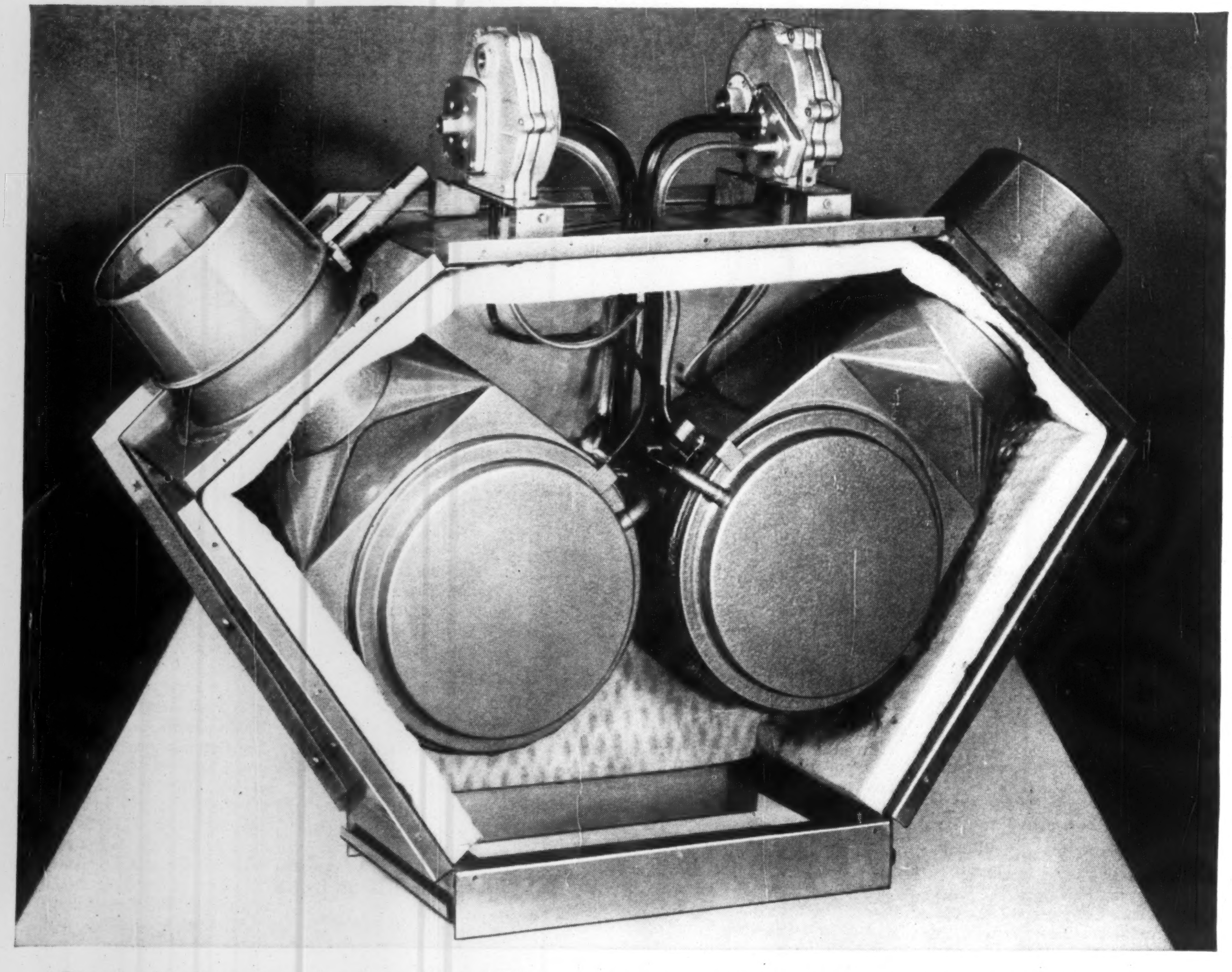
For news about another major Honeywell contribution to indoor climate, turn the page.→



Calibrated dial air balancing is the key to the superior performance of the Honeywell High Velocity Air Blender. You adjust dial only once, need never recalibrate again. Once balanced, comfort control is in the hands of the system thermostats.

Dial Air Balancing

NEW HONEYWELL HIGH VELOCITY



Fits any mixing box. The configuration you see here is but one of the many possible for ceiling units. Also, it's now available in nearly every under-the-window type unit. From the new Honeywell Blender you can expect controlled volume of air, constant CFM, long valve life and simplified control. The thermostat in the system controls temperature by controlling the volume of hot air passed by the hot duct. At the same time a flow regulator provides a constant hot air volume for a given thermostat signal under variations in supply duct pressures. A constant total flow is provided by a total flow regulator which operates the cold air valve to make up the difference between hot flow and desired total flow.

Control leadership through advanced engineering—research

AIR BLENDER SOLVES DUAL-DUCT DISTRIBUTION PROBLEMS

Provides constant delivered air volume, needs no recalibration when you add to system

WITH THE new Honeywell Air Blender your clients get the level of comfort they want—on the simple call of the room thermostat.

They get this easily, because the Honeywell Air Blender combines temperature and volume control in one unit.

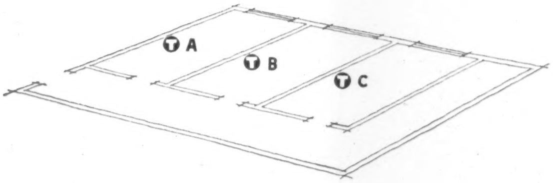
And comfort doesn't come at the expense of some other room. It comes from the system. *One room no longer "robs" another of comfort.*

Besides providing constant delivered air volume, the Honeywell Air Blender takes well to change. With Dial Air Balancing you can add to the system without having to recalibrate distribution points that may be scattered widely—especially valuable in floor by floor modernization or on new construction.

Self-powered, the Honeywell Air Blender uses the pressure of the air it is controlling to actuate the diaphragm—its only moving part. Such simplicity makes possible long life and trouble-free performance.

For further information about the Honeywell High Velocity Air Blender and other Honeywell heating and air conditioning products, call your local Honeywell office. Or write to Minneapolis-Honeywell, Dept. HA-7-226, Minneapolis 8, Minnesota.

No room "robs" comfort from another



For the first time in high velocity air handling history you can design a system where adjustment in one room doesn't upset comfort balance in others. Thus, in a typical office, adjustment in area A does not rob comfort from B or C. Neither delivered air volume, nor the ratio of hot to cold air is affected in B or C. This is one of the reasons why it's wise to design with the new Honeywell Air Blender in mind.

The "new" look in thermostats that's appearing on walls of commercial buildings throughout America. New design *inside* gives closer control, vastly superior performance.

Only Honeywell gives you all four—pneumatic, electric, electronic, instruments.

Honeywell

H First in Controls

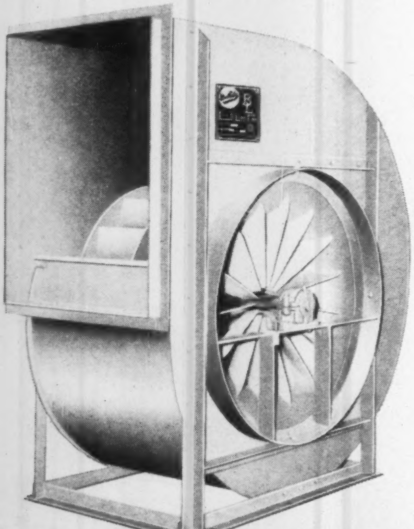
YOUR GUIDE TO

IN CENTRAL SYSTEM

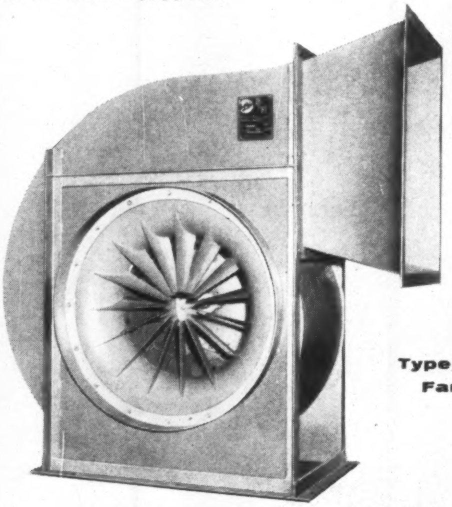
TO SUPPLY LARGE SYSTEMS IN CLASS I SERVICE — The "Buffalo" Type "BL" Fan is engineered to handle the requirements for supplying large ventilation, air conditioning and air cleaning systems. Proved in a wide variety of the biggest installations, the "BL" offers many outstanding characteristics. The "Buffalo" Type "BL" Fan insures extremely dependable, quiet, efficient operation — delivers stable performance from zero pressure to shutoff — is non-overloading over all conditions of system pressure — is available in capacities up to 500,000 cfm, with all drive components for any discharge angle. For maximum performance and complete satisfaction on your systems up to 3¾" pressure, you can safely specify the "Buffalo" Type "BL" Fan. Write for Bulletin F-102.

FOR CLASS II-IV HIGH PRESSURE SERVICE — The "Buffalo" Type "BLH" Fan delivers up to 86% mechanical efficiency — proved in actual performance. This insures complete satisfaction on your modern, high pressure conduit air conditioning, mechanical draft and industrial jobs. The high performance quotient of the "BLH" is possible because of the backward curved blades, and the complete inlet-to-outlet streamlining that are designed into all "Buffalo" Fans. In addition, the "BLH" offers the same noteworthy characteristics that have made the "BL" famous: unusually quiet operation, stable performance, non-overloading factor. The "BLH" is also available in capacities up to 500,000 cfm. Because of this desirable combination of characteristics, the "Buffalo" "BLH" is the fan to specify for Class II to IV heavy-duty ventilating and air conditioning. Write for Bulletin F-200 — it will convince you.

FOR COMPACTNESS, LIGHT WEIGHT AND STRAIGHT-LINE EFFICIENCY — Do you have a space problem? "Buffalo" Axial Flow Fans are duct-size, to fit in close to walls and ceilings. They do an outstanding job in many space-saving applications — from boiler room cooling to paint spray booth exhaust. Important to you are the high efficiencies and rigid construction of this unit, together with compact size. Lighter weight of "Buffalo" Axial Flow Fans means economical installation. Except for the very largest sizes, no heavy foundations or structural supports are needed. These units are often installed as part of the pipe or stack in hood and vat, or other exhaust systems. "Buffalo" Axial Flow Fans are most efficient when mounted in straight duct runs. These units have a reputation for excellent service as duct-mounted boosters in systems. They perform very efficiently as light-duty ventilation, exhaust and industrial air conditioning supply fans. For full details, write today for Bulletin 3533-EF.



Type "BL" Fans



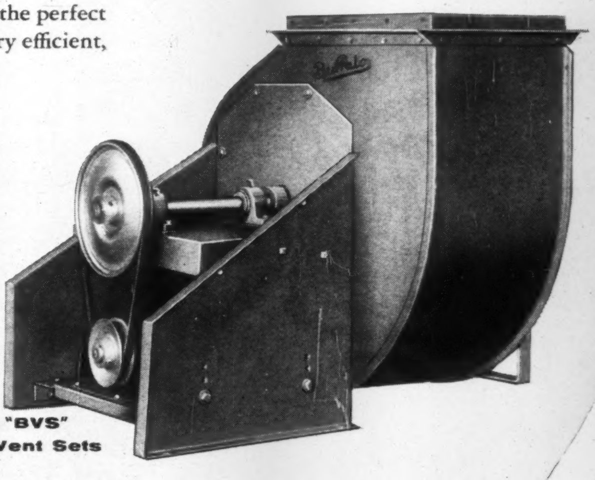
Type "BLH" Fans

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT

THE "BIG FOUR"

VENTILATING JOBS

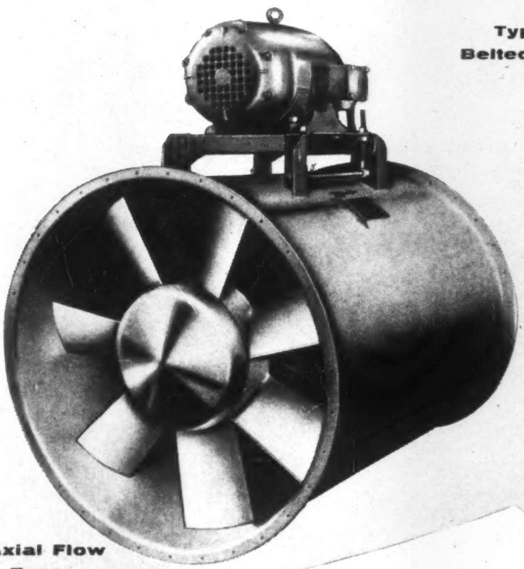
FOR LOW-COST, VERSATILE ZONE VENTILATION — Do you have a zone ventilation problem where quiet operation and flexible approach to your floor space problems are of top importance? Then the "Buffalo" Type "BVS" Belted Vent Sets may well be the perfect solution in every way. "Buffalo" Belted Vent Sets are very efficient, extremely quiet and non-overloading. They offer unusual advantages of economy and adaptability because of their simple "package" installation, either indoors or out. Belted Vent Set capacities range from 1000 to 20,000 cfm. Capacity is adjustable merely by changing sheaves — underscoring their unique versatility. There's a "Buffalo" Vent Set—or combination of sets—to match your precise needs. Bulletin 3720 gives full information; be sure to write for it.



Type "BVS" Belted Vent Sets

All "Buffalo" Fans are Designed and Engineered with the Famous "Q" Factor — the Built-In Quality Which Provides Trouble-Free Satisfaction and Long Life.

Call the Trained "Buffalo" Engineering Representative in Your Nearest Principal City — He Will Be Happy to Work with You on Any Job.



Axial Flow Fans

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Now, trim new Wall-Fin custom styling with

New functional beauty! TRANE Wall-Fin brings draft-free heating plus modern design to long wall and window areas. Large tube diameters make it especially suitable for loop systems where pressure drop is critical. Element is mounted on ball bearings to provide free, silent expansion with no strain on enclosure. New reinforced construction holds shape during shipment and installation. Available in a wide variety of styles to suit any building plan.

from Trane gives you production models!

Simple, rugged construction and smoothly fitting components give you "custom-built" appearance on every job

When you specify new TRANE Wall-Fin, you can depend on getting a trim, neat job with smooth joints and perfect alignment every time. And new TRANE Wall-Fin is ruggedly built with die-formed parts . . . custom-fitted components that will take years of hard use—yet retain their sleek, tailored appearance. Reinforcing channels and gussets at points of strain prevent sagging, bending.

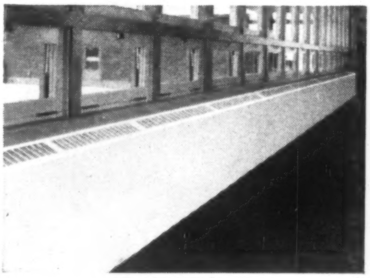
The new TRANE Wall-Fin has been designed with fewer parts . . . with *precision-held dimensions* on all parts to assure a "custom-built" appearance with far less on-the-job fitting and tailoring. New slip-joint construction makes it easy to align, with smooth fit of all joints assured.

Since 1925, TRANE has pioneered in developing and improving radiation products. Now the broadest, most complete line in the industry, TRANE offers you everything you need for any radiation job—whether it's a single room or hallway, or the largest school or hospital. And when you turn to TRANE, you simplify procurement, pinpoint responsibility for *all* your radiation needs.

So for your next job, turn to TRANE! Just call your nearby TRANE Sales Office, or write TRANE, La Crosse, Wisconsin.

Check these new TRANE Wall-Fin features:

- Extra rugged construction—reinforcing channels and gussets at points of strain.
- Precision-held dimensions on all parts—less on-the-job fitting. Fewer parts to assemble.
- Element glides silently on ball-bearing cradles for free expansion without strain on enclosure.
- All mountings are *inside* the cabinet—no interference when cabinet meets baseboard or coving.
- Smoother fit and easier alignment due to slip joint construction.
- Rubber channel strip seals cover to wall.
- Speedier fit-up of all key parts. Slotted holes for element and enclosure; rigid channel-reinforced top edge for easy, tight-to-the-wall fit without bolts or screws; snap-on bottom edge; pre-drilled holes for end laps.
- Wide range of styles, sloping, top or front outlet—available in 4" and 5¼" depth and three heights, for steam or hot water.
- Complete precision-built accessories—dampers, access doors, pilaster covers and end panels give real custom-built appearance.



TRANE Convectors combine efficiency with compactness and beauty. Aluminum-copper heating element responds quickly, provides heat instantly . . . eliminates wasteful overheating. Can be installed free-standing, recessed or wall-hung. 21 cabinet styles to choose from.

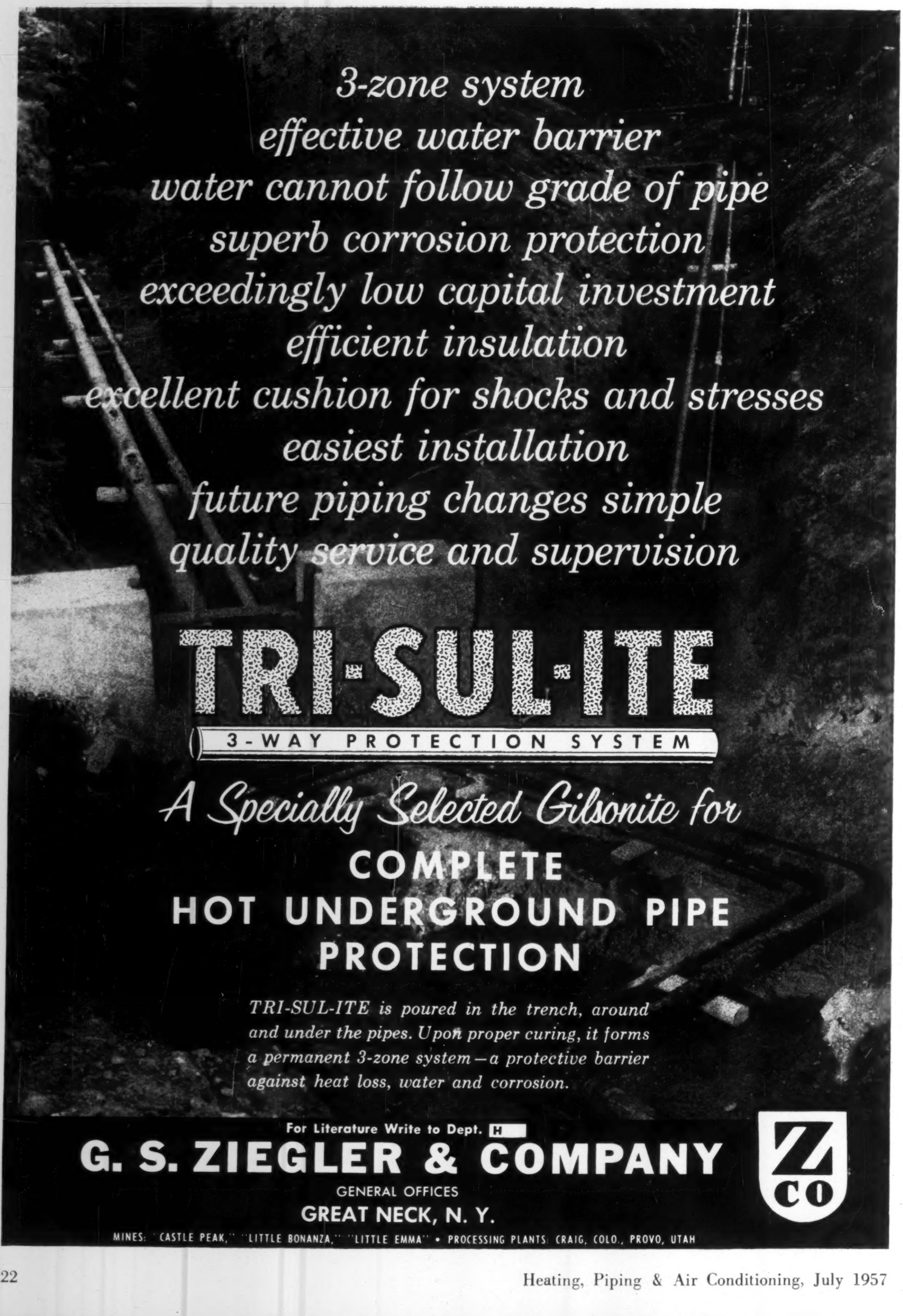
TRANE Wall-Line Convectors are designed for relatively short runs and very high capacity—providing attractive, modern wall-to-wall installations in schools, office buildings, hospitals and institutions. Compact and rugged construction, with extra reinforcements and full back.

For any air condition, turn to

TRANE

MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

THE TRANE COMPANY, LA CROSSE, WIS. • EASTERN MFG. DIV., SCRANTON, PA. • TRANE COMPANY OF CANADA, LTD., TORONTO
90 U. S. AND 19 CANADIAN OFFICES



3-zone system
effective water barrier
water cannot follow grade of pipe
superb corrosion protection
exceedingly low capital investment
efficient insulation
excellent cushion for shocks and stresses
easiest installation
future piping changes simple
quality service and supervision

TRI-SUL-ITE

3-WAY PROTECTION SYSTEM

A Specially Selected Gilsonite for

COMPLETE HOT UNDERGROUND PIPE PROTECTION

TRI-SUL-ITE is poured in the trench, around and under the pipes. Upon proper curing, it forms a permanent 3-zone system—a protective barrier against heat loss, water and corrosion.

For Literature Write to Dept. H

G. S. ZIEGLER & COMPANY

GENERAL OFFICES
GREAT NECK, N. Y.

Z CO

MINES: "CASTLE PEAK," "LITTLE BONANZA," "LITTLE EMMA" • PROCESSING PLANTS: CRAIG, COLO., PROVO, UTAH

solid wedge,
inside screw,
non-rising stem
split wedge,
inside screw,
rising stem
solid wedge,
inside screw,
rising stem
Safe, Tight
...Trouble-free

. . . with *union* body-bonnet joint on 125 lb., 150 lb., 200 lb. pressure classes

Be safer—and save! Greater operating safety, positive shutoff, and low upkeep costs are the prime advantages of modern OIC bronze gate valve designs in all pressure classes.

Union ring nut provides safety-tight body-bonnet joint

The separate union nut seals the bonnet and body mating surfaces, effecting a tight, leak-proof joint. Possibility of distorting body and bonnet during disassembly and assembly and of loosening the joint during operation are virtually eliminated.

OIC design reduces maintenance costs

Necessity for stem replacement can be forgotten, because stems are special, long-lived OIC *Alloy-40.* This sturdy material eliminates galling and seizing and contributes to easy operation.

Stem threads are never exposed to line fluids in open or closed positions (125 lb. and 150 lb.), preventing thread abrasion from line fluids or suspended solids.

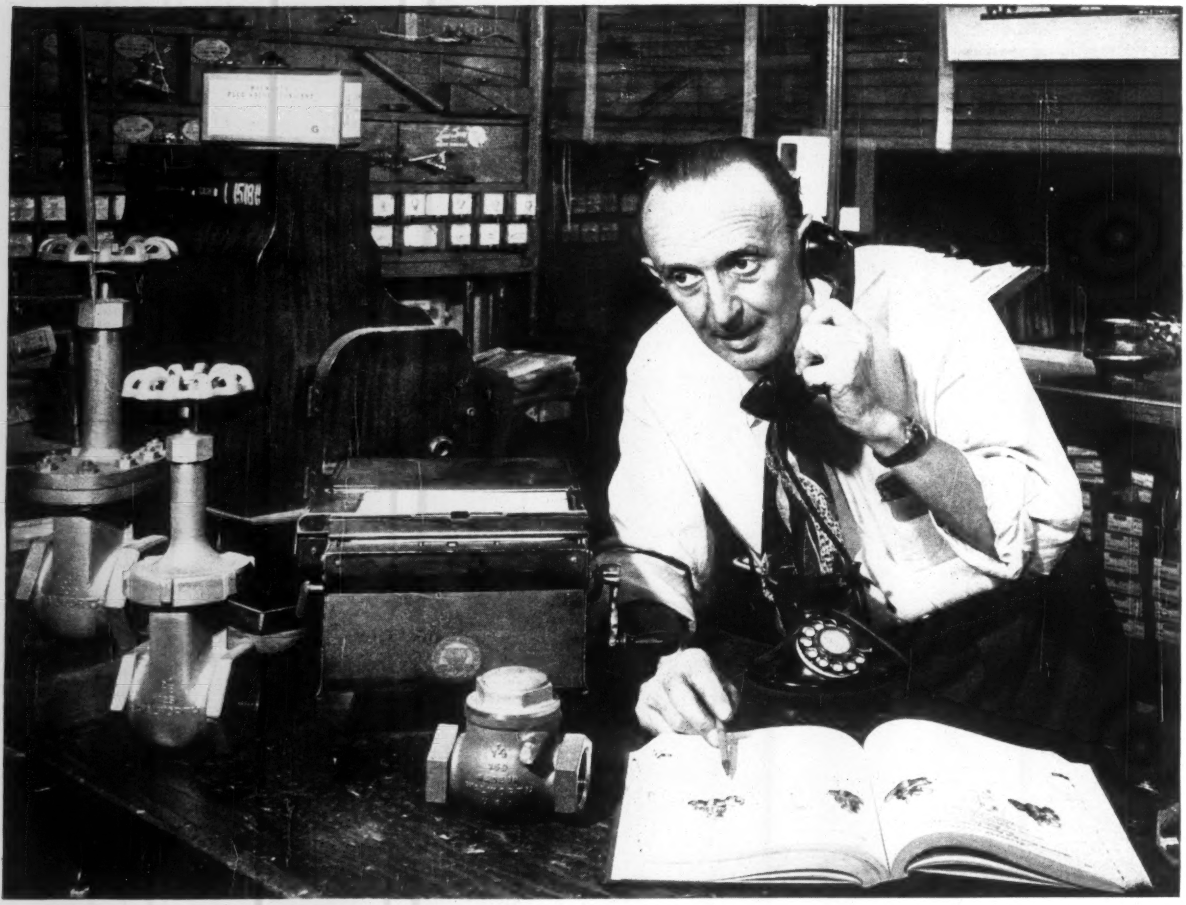
All pressure parts are designed for maximum strength, and working parts are hydrostatically tested for positive sealing and seating. Write for our folder, No. 1006. ***Order from your OIC distributor.***

OIC
FOUNDED 1883

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

VALVES

FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES



*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical — emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth — a complete line manufacturer.

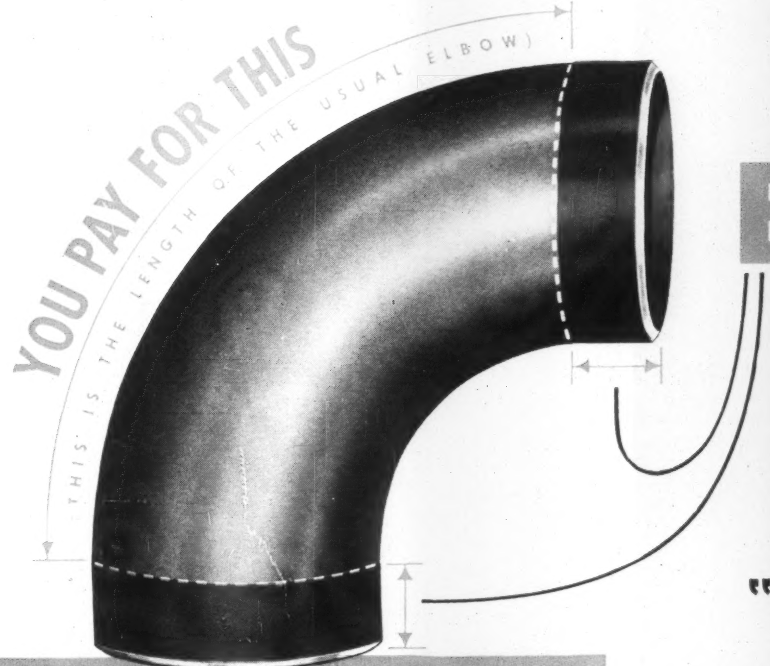
There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto



YOU GET A BONUS WITH EVERY MIDWEST "LONG TANGENT" ELBOW

21% to 42% MORE ELBOW AT NO EXTRA COST

It's a built-in bonus that comes right with the elbow . . . a tangent or straight section at each end of the fitting.* Benefits of this bonus . . . this extra value . . . are yours AT NO EXTRA COST because Midwest "Long Tangent" Elbows are PRICED THE SAME AS OTHER ELBOWS. It's a value you can't afford to miss.

For additional information, ask your Midwest distributor or write us for Catalog 54.

*Size 24″ and smaller have tangents equal to ¼ nominal pipe size; for example, 12″ ell has 3″ straight ends. Above 24″ pipe size, all tangents are 6″ long.

ADVANTAGES OF MIDWEST "LONG TANGENT" ELBOWS

- They save pipe.
- They often eliminate short nipples and their extra welds.
- They save time and money in lining up and clamping pipe and fitting.
- They make it easier to apply slip-on flanges.
- They remove the circumferential weld from point of maximum stress and can be sleeved.

THEY COST NO MORE THAN OTHER ELBOWS

MIDWEST PIPING COMPANY, INC.
Main Office 1450 South Second St., St. Louis 4, Mo.
Plants: St. Louis, Clifton, N. J. and Los Angeles

SALES OFFICES: ASHEVILLE (BOX 446, SKYLAND, N.C.) • BOSTON 27—426 FIRST ST. • CHICAGO 3—79 WEST MONROE ST. • CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE. • LOS ANGELES 33—520 ANDERSON ST. • MIAMI 34—2103 LE JEUNE RD. • NEW YORK 7—50 CHURCH ST.
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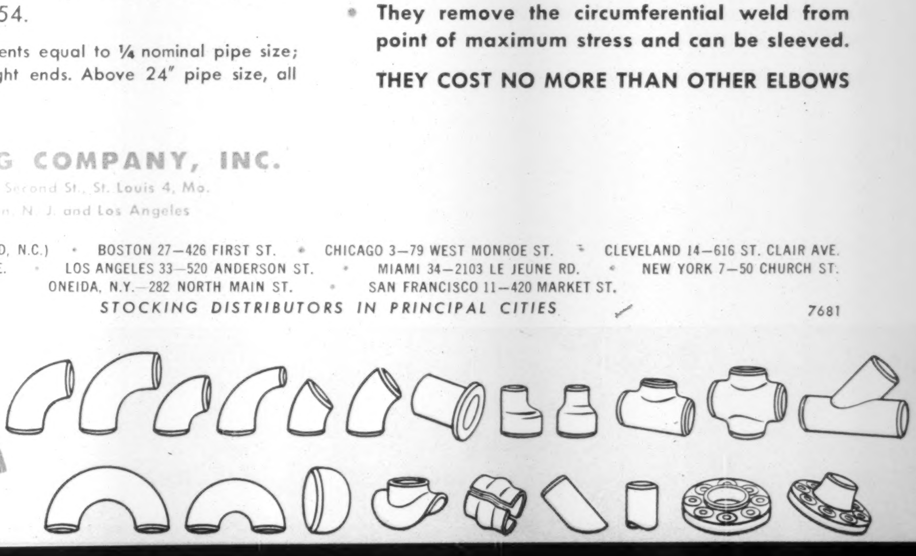
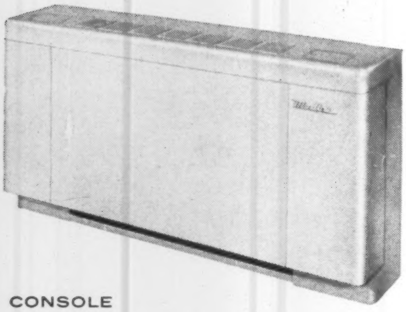
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

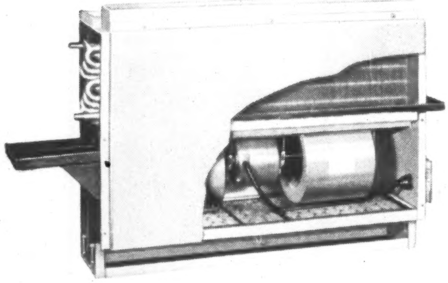
7681

MIDWEST WELDING FITTINGS IMPROVE PIPING DESIGN AND REDUCE COSTS



Why those who want the finest in


CONSOLE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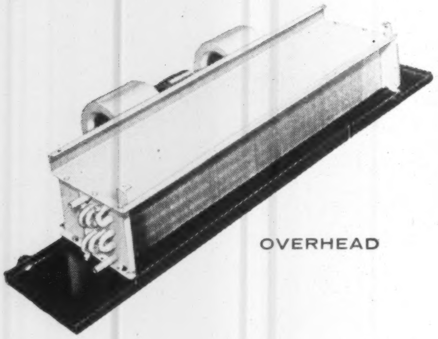
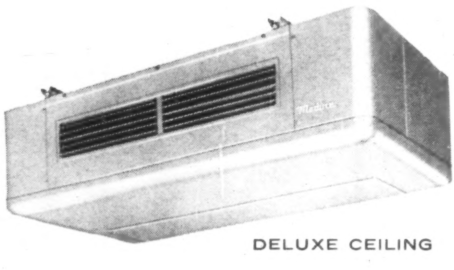
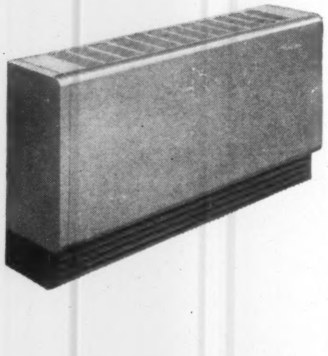

OVERHEAD


DELUXE CEILING

Modine *Airditioners*®

Popular fan-coil units for cooling with chilled water, heating with hot water—from a central source. For year-round air conditioning in multi-room installations. Offered in console, ceiling and concealed overhead and in-the-wall types. Four sizes range from 2/3 to 2 tons of refrigeration. Ask for Bulletin 757.



Modine CABINET UNITS

An extremely versatile line of heating and ventilating units providing quiet, positive distribution of heated air with or without ductwork. Models for cooling with chilled water. Seven distinct enclosure types, plus a variety of accessories, permit matching practically any installation or performance requirement. Capacities from 120 to 640 Edr. Write for Catalog 557.

heating and air conditioning say...

make mine Modine

Among building professionals and owners, the high quality of Modine heating and air conditioning equipment has long been recognized. Careful examination proves it to be a tangible value which benefits those who specify, install and use Modine products. This quality is a direct result of a company policy which is briefly expressed as follows—

"Modine products, while not premium-priced, are produced to meet those high standards of mechanical construction and performance excellence which long experience has proved essential to complete user satisfaction."

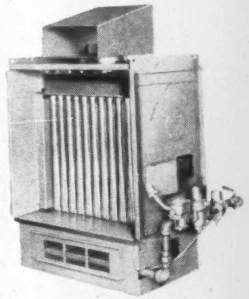
Modine GAS UNIT HEATERS

Beautifully styled units feature light weight for easy, low-cost installation . . . stainless steel burners and stainless or aluminized steel heat exchangers for longer life . . . advanced engineering design for outstanding heating performance. Eight sizes from 25,000 to 310,000 Btu. Catalog 656-A.

Modine STEAM AND HOT WATER UNIT HEATERS

Widest line available — includes horizontal and vertical delivery types plus Power-Throw models for use where extremely long "throw" is needed. All types are available in HCR models designed for application where severe internal corrosion is a problem. Bulletin 157.

Modine DUCT FURNACES



Ideal for use with cooling package or for straight heating. Stainless steel burner and heat exchanger resist rust and corrosion caused by moisture-laden air or condensation. Five sizes from 88,000 to 213,000 Btu. Bulletin 855.

Modine CONVECTORS

Attractive appearance and sturdy construction characterize the Modine line of convector radiation. Offered in 30 types and 8,000 sizes for every building need. Choice of standard or heavy-gauge enclosures. Catalog 257.

UR-1353

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MANUFACTURING COMPANY

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Youngstown Distributors are in business for only one reason—to quickly supply what you want, when you want it, and in the quantity you require. They provide you the highest quality Youngstown Pipe at the right price—by coordinating their distribution with our mill production. Yes, our hat's really off to these valuable around-the-clock suppliers for the important function they daily perform to industry.

It will pay you to know and use your Youngstown Distributor because his:

- Large stocks are immediately available which allows a reduction in your inventory.
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Your Youngstown Distributor is as near as your telephone—why not call him today?

Specify Youngstown and secure these
7 Points of uniform goodness

uniform ductility
uniform lengths
uniform threading
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uniform wall thickness and size
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THE Youngstown SHEET AND TUBE COMPANY

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QUALITY YOUNGSTOWN SERVICE

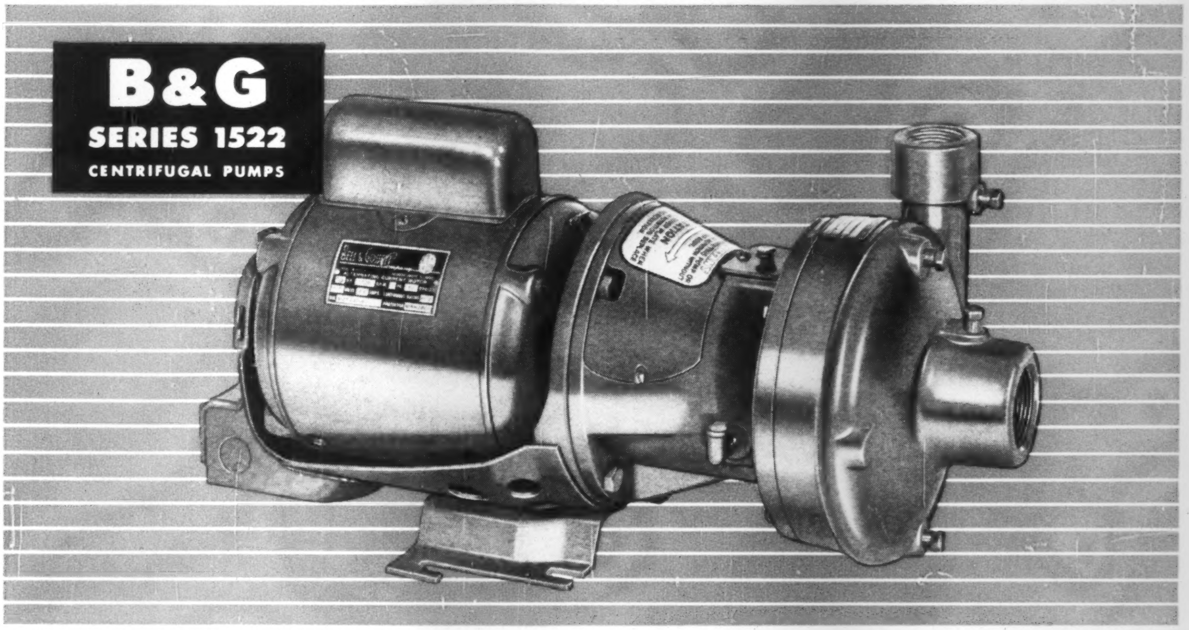
YOUNGSTOWN PIPE

PRODUCERS OF QUALITY CARBON AND ALLOY STEELS FOR OVER HALF-A-CENTURY

B&G

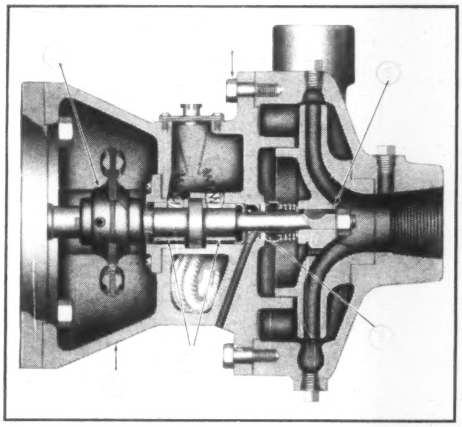
SERIES 1522

CENTRIFUGAL PUMPS



REALLY Quiet!

...your answer to noise problems in cooling tower installations



In the B&G Series 1522 Pump, noise has been engineered out... together with usual causes of unsatisfactory performance.

The cut-away illustration at left tells the story—

1. Long bronze sleeve bearings in both the pump and motor assure quiet operation.

2. Spring-type flexible coupling makes a noise-dampening connection between pump and motor.

3. "Remite" Mechanical Seal positively ends leakage. Harder than glass—wearproof—self-lubricating.

4. Bearing bracket sub-assembly, including shaft and sleeve bearing, is easily removed and is interchangeable in all B&G 1522 Pumps.

5. Dynamic balancing of the impeller prevents shaft vibration and seal failure. Balancing chamber and relief holes eliminate thrust load on pump bearings.

6. Easily serviced. Removal of a few bolts permits separation into three parts.

B&G Series 1522 Pumps are available as all-iron, bronze-fitted, all-bronze or stainless steel units. Capacities to 150 GPM, heads to 115 ft. Send for catalog.

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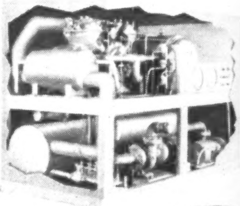
PACKAGE LIQUID COOLERS

Completely integrated cooling units for apartments, commercial and industrial buildings, process work

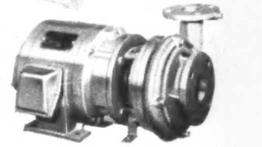


EVAPORATORS AND CONDENSERS

Plus values in efficiency designing—built to ASME Code requirements.

CENTRIFUGAL PUMPS

Featuring exclusive, leak-proof "Remite" Mechanical Seal—*quiet* operation. Ideal for air conditioning installations.



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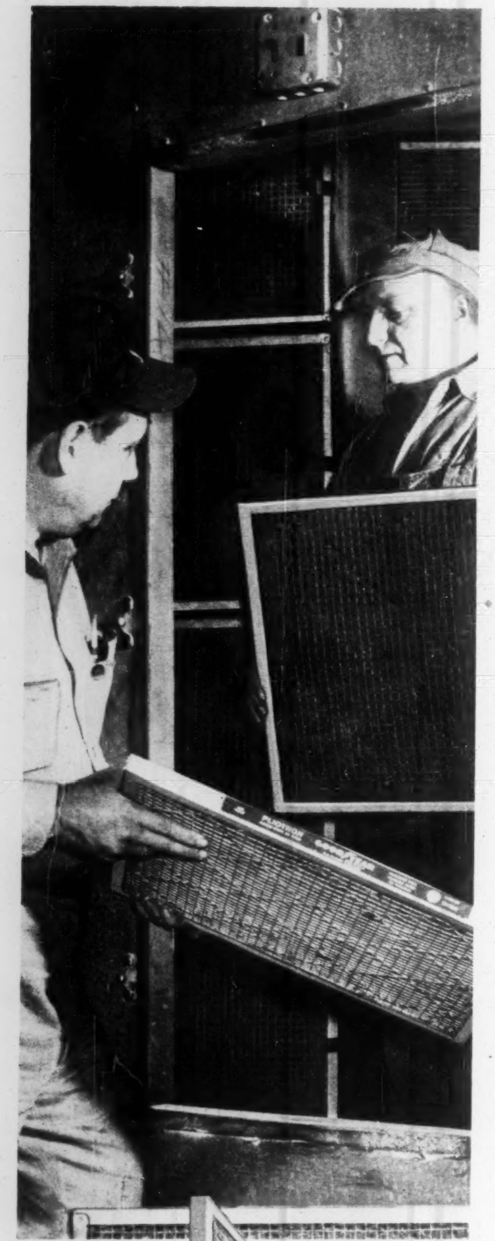
Dept. RZW-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario



They're building reputations

installation by installation!

No question about the success of this filter installation in a large, modern bakery. It does a better job of filtering air to the cooler—taking the heat off 100,000 loaves of bread a day on their journey from oven to wrapper. And it saved the user a projected 70% of his "normal" annual filter costs.

Naturally, this reflected plenty of credit on the men who recommended and installed PLIOTRON super-filters. Customers are always quick to appreciate work that saves them time lost in premature replacements. And usually they pass on their satisfaction—in more business and valuable word-of-mouth advertising.

When you install PLIOTRON, they have plenty to talk about, too: It captures up to 5 times as many fine dirt particles as ordinary filters. Since it's a depth-loader—not a surface-loader—it works efficiently far longer between cleanings. And when dirty, a quick bath restores its full efficiency.

So it's easy to see why users are willing to pay the extra initial cost of PLIOTRON filters. And these super-filters boost the reputation of everyone who recommends them—installation after installation. For details, write:

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for cleaner air everywhere-

PLIOTRON AIR FILTER BY

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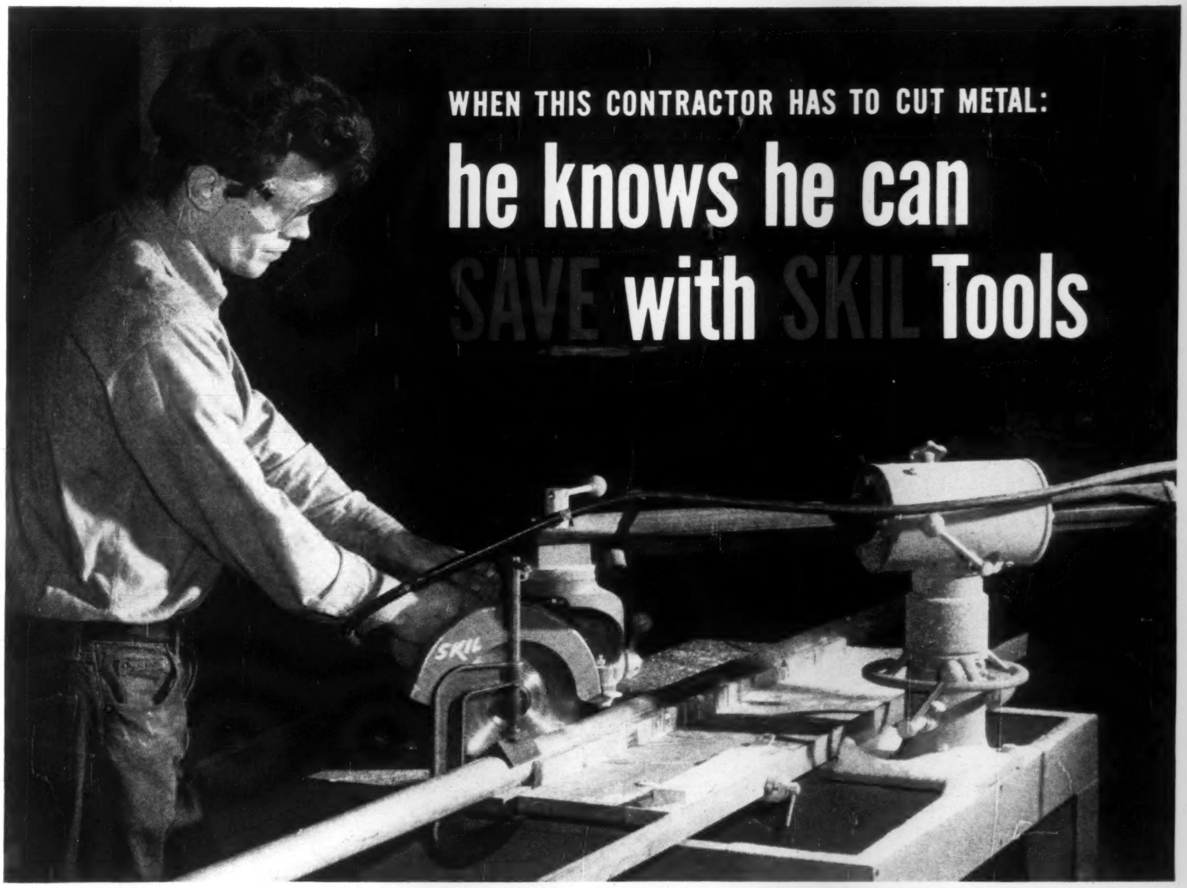
THE GREATEST NAME IN RUBBER

Pliotron—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio



Saves $300 in six months

Increases Production 60%

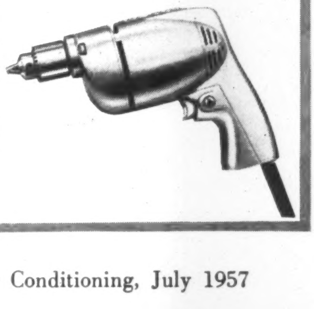
The Limbach Company knows they SAVE with SKIL tools! They do it every day with the SKIL Portable Radial Saw shown in operation at their plant in Columbus, Ohio.

The operator is cutting 6000 series aluminum tubing. Plant Engineer Jack Tallant says: "We increased production on this operation by 60% with the SKIL Model 649 Radial. Within six months it paid for itself!"

This SKIL Portable Radial replaced a bandsaw that cut too slowly and required extended set-up time. Model 649 is portable—weighs only 170 lbs. Can be used on-the-job or in the shop. Quickly cuts most metals, compositions, plastics, laminates and wood. Powerful 1½ H.P. universal-type motor. See your SKIL distributor for more information or use the coupon below.

ALL-AROUND ¼" DRILL

Save with Heavy-Duty SKIL ¼" Drill. High power output for any type drilling. For installation, fabrication, utility or maintenance, model 75 does the best all-around job.



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Armour and Co. use "cold" in many ways in their great Pharmaceutical Laboratories, recently opened near Kankakee, Ill. These uses include air conditioning, biological process work, cold storage, heat-pump service, and research.

Temperatures can be held anywhere between —45 and +45 degrees F., but usually go no lower than —10.

Here a 2-stage Frick system of 1422 tons refrigerating capacity operates with efficiency and economy. Installation by Midwest Engineering and Equipment Co., Frick Sales-Representatives in Chicago.

For that important refrigerating, air conditioning, ice making or quick freezing job of yours, look to dependable Frick equipment. Sales-engineering and service, the world over. Let us submit estimates now: write, wire or phone

DEPENDABLE REFRIGERATION SINCE 1882
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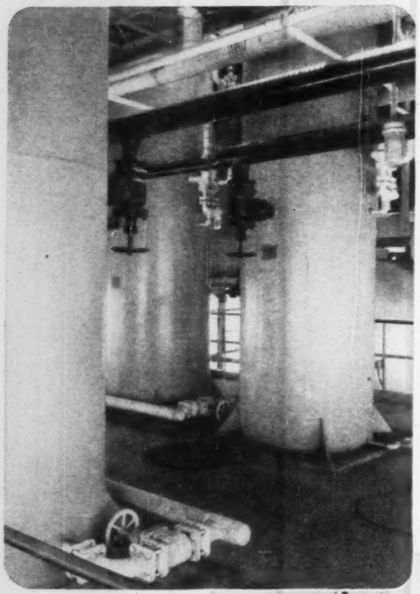
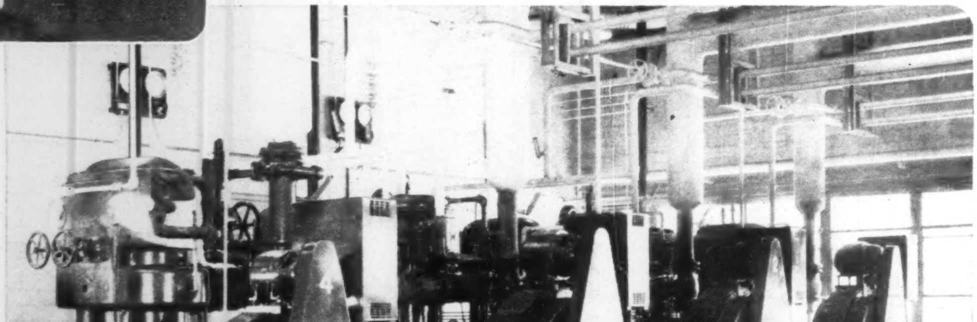
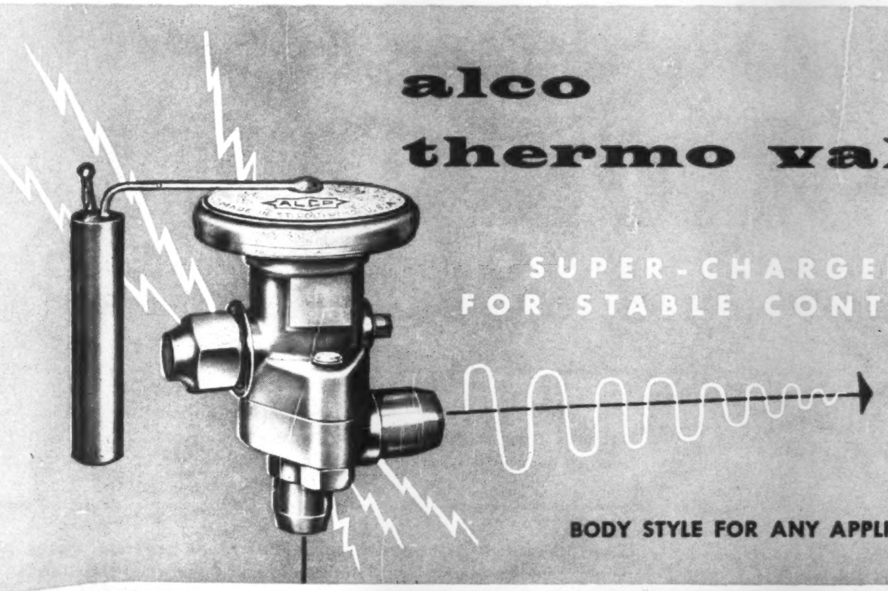


Above: Three of four Shell-and-tube condensers at the Laboratories.



Right: Four of eleven ammonia compressors furnishing refrigeration at temperatures down to —45° F. for The Armour Laboratories, Kankakee, Ill.

alco thermo valves



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BODY STYLE FOR ANY APPLICATION

ALCO SUPER CHARGES

Range (Evaporator Temperatures)	Charge Type	Application Examples	Refrigerant				
			Freon-12 †(Yellow)	Freon-22 †(Green)	Methyl Chloride †(Red)	Carrene-7 †(Orange)	Propane †(Black)
			Charge Symbol				
30° F. to 50° F.	Gas	Air Conditioning, Water Chillers, Etc.	*55# MOP **FG**	*100# MOP **HG**	*55# MOP **MG**	*65# MOP **CG**	*100# MOP **PG**
0° F. and Above	New Improved Liquid Charge	Industrial, Commercial, Display Cases, Unit Coolers, Etc.	**F**	**H**	**M**	**C**	**P**
0° F. to −40° F.	Low Temperature Cross Charge	Locker Plants, Freezers, Hardening Rooms, Cabinets, Etc.	**FZ**	**HZ**	**MZ**	**CZ**	**PZ**
"X" CHARGE (ZZ VALVES)							
—40° F. and Below	Ultra Low Temperature Cross Charge	Altitude Chambers, Scientific Equipment, Industrial Processing, Etc.	**FX**	**HX**			**PX**

* The M.O.P. (Maximum Operating Pressures) shown above are standard. Others available upon request.
† Color of nameplate identifies refrigerant.

. . . straight-through or angle connections . . . solder or SAE flare.
For all temperature ranges—all operating conditions.
Specify type desired when you order.

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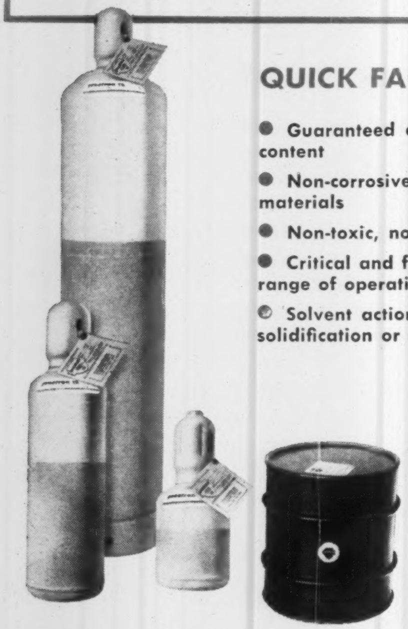
genetron® super-dry REFRIGERANTS

a complete line for your every need!

genetron 11—ORANGE LABEL TRICHLOROMONOFLUOROMETHANE	For industrial and commercial refrigeration and air conditioning systems using single or multi-stage centrifugal compressors. Can also be used for either direct or indirect expansion-type systems.
genetron 12—WHITE LABEL DICHLORODIFLUOROMETHANE **genetron 22**—GREEN LABEL MONOCHLORODIFLUOROMETHANE	Used in virtually all types of refrigeration and air conditioning equipment, large and small, household and industrial, direct and indirect expansion systems. Typical units in which "Genetron" 12 and 22 are used: refrigerators, freezers, frozen food lockers, window air conditioners, home or office console units, large custom-built units for commercial comfort or industrial processes, large store units, mobile units for transportation equipment, large home units for addition to present hot air heating systems.
genetron 113—PURPLE LABEL TRICHLOROTRIFLUOROETHANE	Used in 50-ton and larger centrifugal compressors, primarily for large comfort cooling systems, brine cooling systems, and other commercial and industrial air conditioning and refrigeration systems.
genetron 114A—BLUE LABEL DICHLOROTETRAFLUOROETHANE	Used in centrifugal and rotary compressors for commercial, industrial and household refrigeration.



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- Guaranteed exceptionally low moisture content
- Non-corrosive to standard equipment materials
- Non-toxic, non-flammable, stable, safe
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- Solvent action on oil helps prevent solidification or congealing of lubricant
- Freely interchangeable and may be mixed in any proportions with comparable fluorinated hydrocarbons meeting the same strict refrigerant specifications
- Aid in lubrication of equipment; generally miscible with oil
- Available everywhere, from refrigeration wholesalers throughout the country

GC
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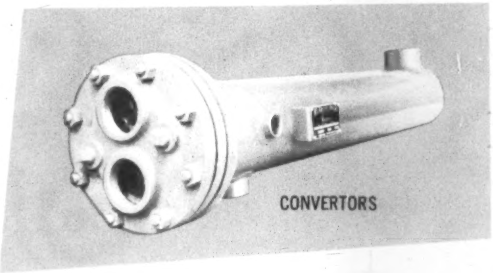
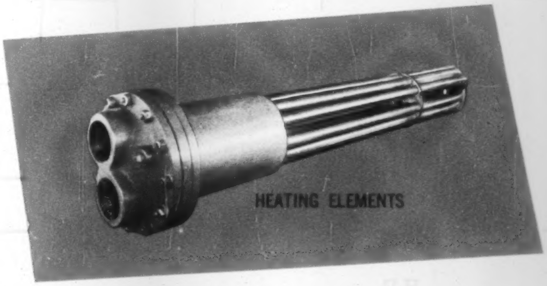
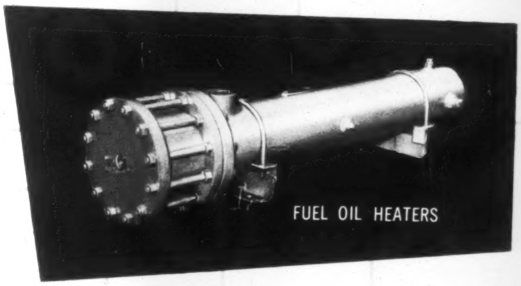
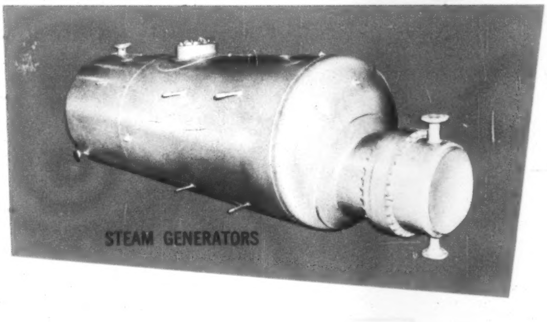
Paracoil Heat Transfer Equipment puts HIGH TEMPERATURE HOT WATER to work









Over the years, Paracoil Heat Transfer Equipment has been answering the needs of industry by converting efficiently distributed high temperature hot water to effective local use at serviceable temperatures and pressures.

The Davis Engineering Corporation has pioneered equipment specially designed to make HTHW a practical heat transfer medium. Here are just some of the Paracoil products specified by Consulting Engineers for various service applications.

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Space Heating — radiators, radiant heating panels, etc.

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PARACOIL HEATING ELEMENTS FOR:

Hot Water Storage Tanks — installed in office buildings, laundries, schools, gymnasiums, factories, hospitals, etc.

PARACOIL STEAM GENERATORS FOR:

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PARACOIL FUEL OIL PREHEATING SYSTEMS:

designed to eliminate contamination through isolation of HTHW from the fuel oil.

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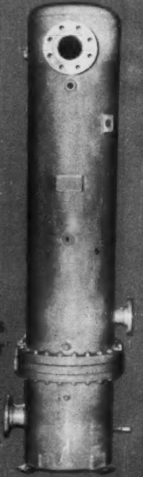
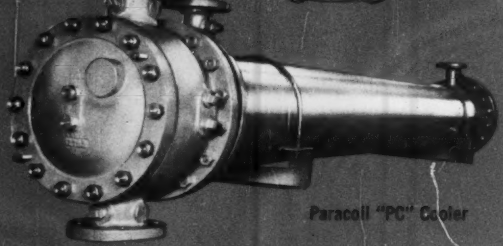
Davis Engineering Corporation builds a complete line of Heat Exchangers for industrial and process applications

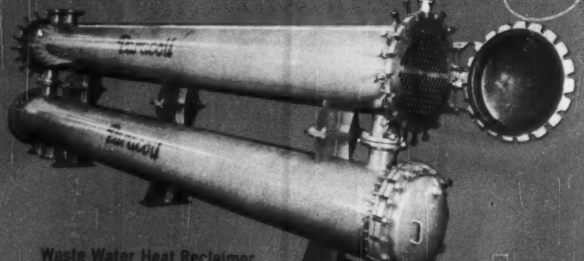
Vertical Tank Suction Fuel Oil Heater (Steam Type)



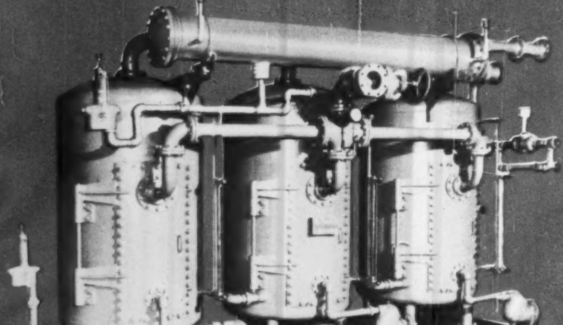
LP-Gas Vaporizer



Paracoil "PC" Cooler



Waste Water Heat Reclaimer



Paracoil Distillation Plant

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blowdown exchangers

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  solvent, vent

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  brine, freon

coolers, industrial
  condensate, jacket water
  lube oil, quenching oil
  boiler-water sample, drain

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  fresh water; salt water

economizers

evaporators
  freon, water distilling,
  boiler-feed water make-up,
  contaminated water,
  fresh-water, salt-water

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filters
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  charcoal, feedwater

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  indirect and tankless

heaters, exhaust gas

heaters, feedwater
  coil type, standard
  and improved
  straight and U-tube types

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heaters, general
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  for distillation of sea,
  river, lake or spring water

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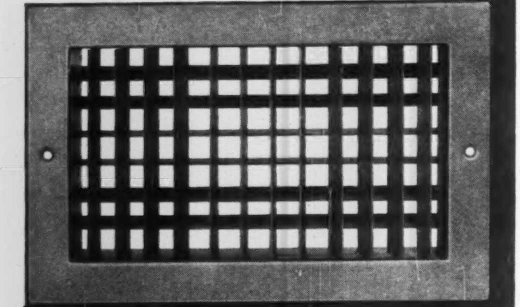

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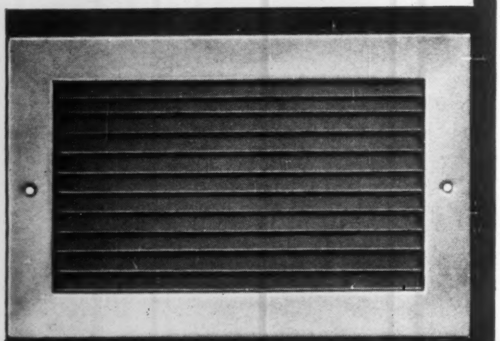
Two sets of adjustable louvres, front vertical, rear horizontal.



Style 3H Return Air Grille
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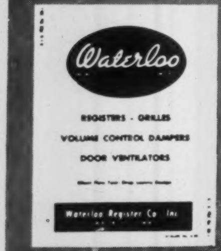
WIDE RANGE LINE

Whatever your specific needs, you will find the unit you want in Waterloo's complete line of supply and return registers and grilles. We also manufacture quality volume control dampers and door ventilators.

FAST SERVICE

Waterloo delivers . . . when you need it! Specials can be turned out in a hurry to meet job requirements.

These are *five* good reasons why it pays to make Waterloo your *buy-word*.



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REGISTERS - GRILLES
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DOOR VENTILATORS

Waterloo Register Co. Inc.

Write for Catalog, containing complete data on all Waterloo air diffusion equipment.

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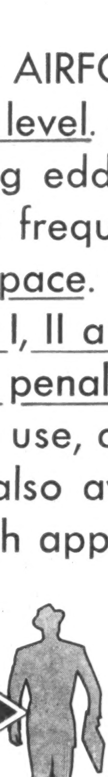
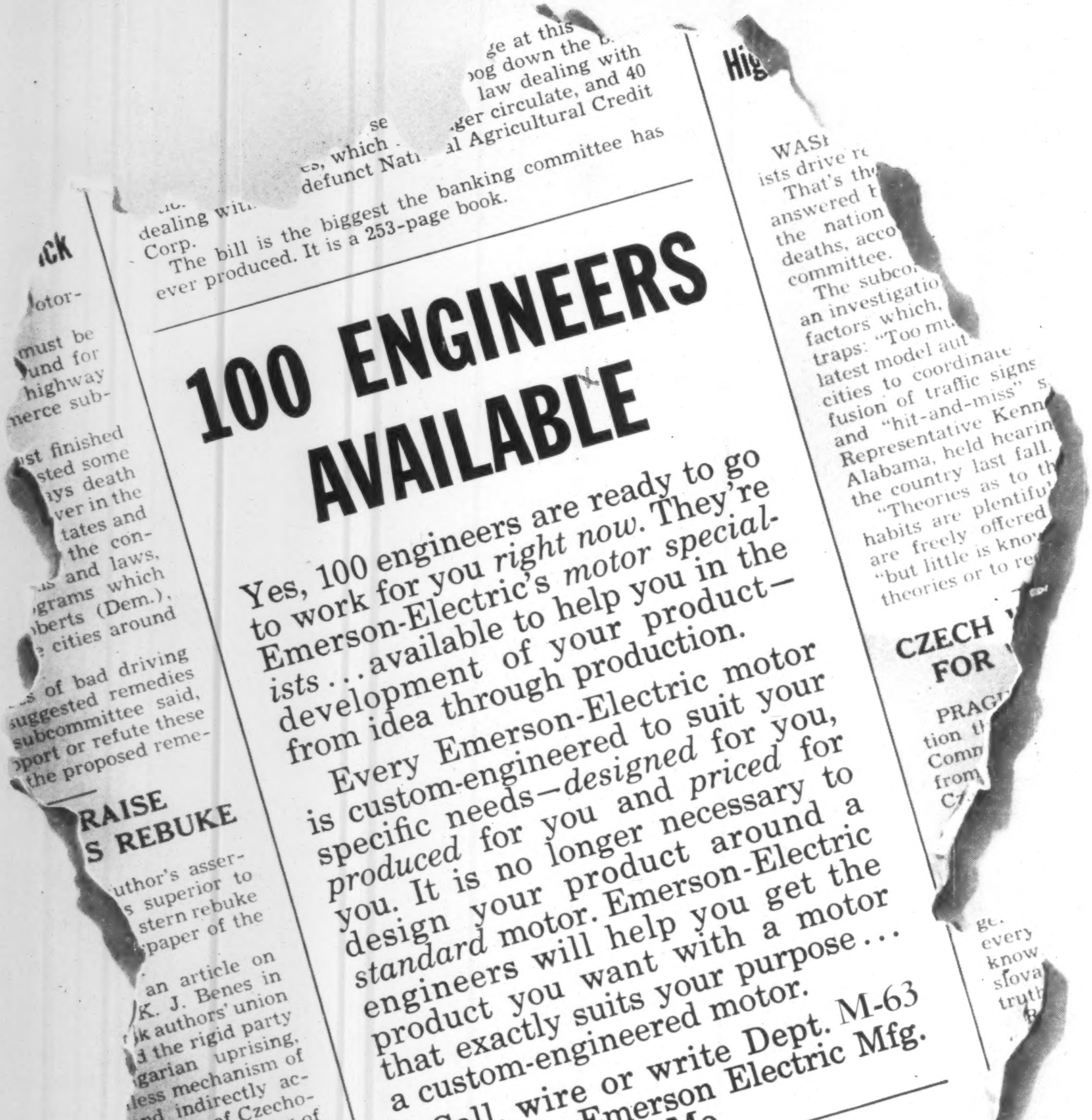
ILG Type BC AIRFOIL CENTRIFUGAL FANS deliver more air at lower sound level. Airfoil blade design increases fan efficiency by eliminating eddy currents, reducing shock loss. Because of this, you can frequently specify and use a smaller unit, saving money and space. Heavy duty, all aluminum construction meets NAFM Class I, II and III requirements up to 9" static pressure without price penalty. Direct-connected motors, designed specifically for fan use, assure long life and trouble-free operation. Belted type also available. NAFM label certifies ratings in accordance with approved test codes.



The Man from Ilg can help you plan for efficient ventilation at lowest final cost.
Talk your ventilation problems over with The Man from Ilg.

ILG ELECTRIC VENTILATING CO.
2826 N. Pulaski Road, Chicago 41, Illinois • Offices in 56 Principal Cities

Send For New Catalog on Ilg Type BC Airfoil Centrifugal Fans
Fully describes advantages and exclusive engineering features . . . complete ordering information, general engineering data. 32 pages. Request Catalog #257.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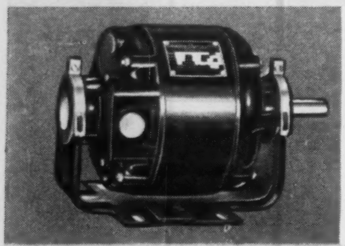
100 ENGINEERS AVAILABLE

Yes, 100 engineers are ready to go to work for you *right now*. They're Emerson-Electric's *motor specialists* . . . available to help you in the development of your product—from idea through production.

Every Emerson-Electric motor is custom-engineered to suit your specific needs—*designed* for you, *produced* for you and *priced* for you. It is no longer necessary to design your product around a *standard* motor. Emerson-Electric engineers will help you get the product you want with a motor that exactly suits your purpose . . . a custom-engineered motor.

Call, wire or write Dept. M-63 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.



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Since 1890

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TMCO
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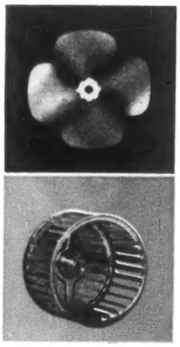
LINE OF LEAST RESISTANCE

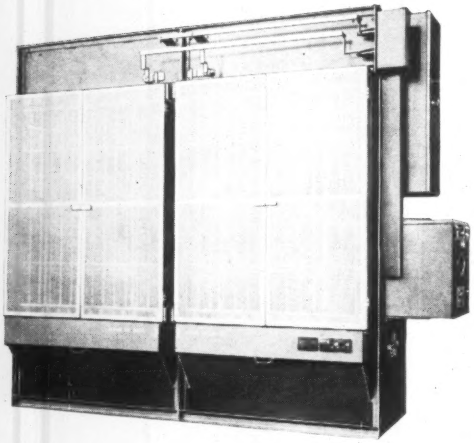


Torrington now offers to manufacturers in the air conditioning, heating and ventilating industry the most complete line of air moving units in the world . . . and in the three basic areas of air impeller development: fans, airotors and complete blower units. Backed by the industry's finest research and development facilities, Torrington engineers work *only* on air moving problems and products. No matter what yours may be, try the line of least resistance: *Talk to Torrington!*

THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

Even this air filter
can't meet all needs



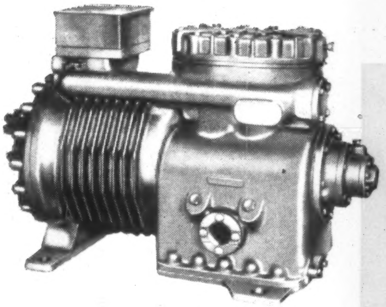
...and it's the world's finest!

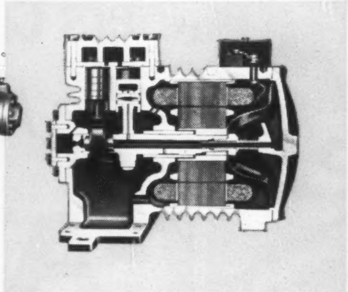
Either way you look at it—air cleaning efficiency or ease of maintenance—the AAF Electro-Matic is the ultimate in air filters. This electrostatic precipitator removes the tiniest dust particles (even smoke) from the air, and continually cleans itself at the same time!

But even this filter can't meet all the varied clean air needs of business and industry. That's why it's only one of dozens of filters in the AAF line.

Your needs—and only your needs—should determine what type of air filter you select. Talk with AAF, the company that *offers* a selection.

AAF herman nelson American Air Filter
COMPANY, INC.
373 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P.Q.





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THE *Accessible* HERMETIC

You can get to direct-drive Copelametic units effortlessly... in a jiffy. No belts or seals, no manual oiling. 90% of service costs eliminated. Models for all applications—air-cooled—from ⅓ through 5 H.P. Water-cooled ⅓ H. P. through 10 H.P.

Copeland
DEPENDABLE Refrigeration
COPELMETIC
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REFRIGERATION CORP.
SIDNEY, OHIO

the easy way to solve a tough problem

So you have a reputation to maintain for high-quality installations in the air-conditioning and refrigeration fields.

And you have worries. You must meet and beat competition. The quality and performance of what you get from your suppliers are a constant concern.

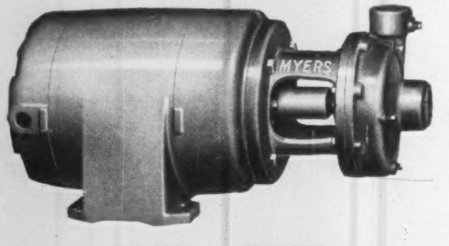
That's the perfect time to make sure there's a Copeland motor-compressor or condensing unit in every piece of equipment you install. For Copeland units are masterfully designed, painstakingly built, are standard with leading manufacturers. Now they're streaming from our spanking-new plant—270,000 square feet of America's most modern manufacturing facilities.

LIVE BETTER ELECTRICALLY

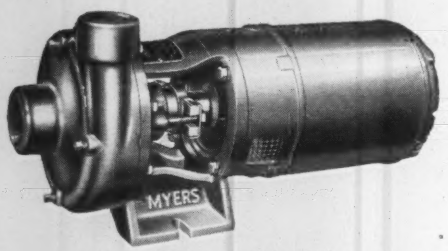
MANUFACTURERS OF THE HEART OF AMERICA'S FINEST AIR CONDITIONING AND COMMERCIAL REFRIGERATION UNITS

SINCE 1918

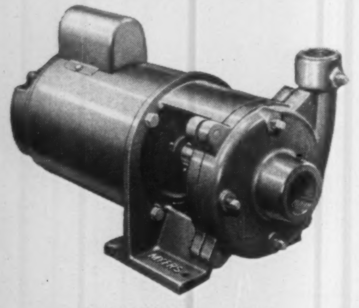
Copeland REFRIGERATION CORPORATION, Sidney, Ohio



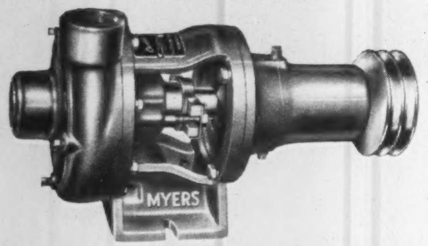
Model 150M Model 200M
Shown with rotary seal (available with stuffing box)



Model 125M Model 150M
Shown with stuffing box (available with rotary seal)



Model 100M—Rotary seal only



Model 125B Model 150B Model 200B
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(available with rotary seal)

Model 100B—Rotary seal only

Myers Centri-Thrift Pumps for Air Conditioning

PAY OFF 3 WAYS

1 Longer Continuous Performance

- All-bronze impeller, accurately balanced for smooth operation.
- Removable bronze wearing ring, easily replaced.
- Corrosion resistant, stainless steel shaft.
- Backed with a warranty unsurpassed in the industry.

2 Complete Line to Meet Any Specification

- Full range of sizes: 1″ x 1¼″, 1¼″ x 1½″, 1½″ x 2″, 2″ x 2½″, threaded discharge and suction. ⅓, ½, ¾, 1, 1½, 2, 3, 5 and 7½ horsepower, motor-mounted or belt driven.
- Regularly fitted with high quality rotary ceramic-faced seal. Stuffing box may be specified on "125", "150" and "200" models.
- Choice of motors: single or three phase, single or dual voltage, open or enclosed.
- Competitively priced.

3 Field-proven Service

- Capacities to 240 gallons per minute. Heads to 140 feet.

WRITE TODAY FOR SECTION 210 ON MYERS CENTRI-THRIFT PUMPS

Myers® PUMPS

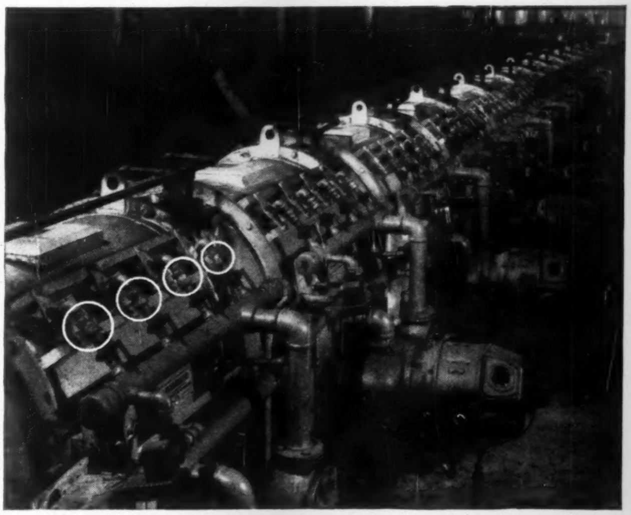
THE F. E. MYERS & BRO. CO. • ASHLAND, OHIO • KITCHENER, ONTARIO Myers®

Tough jobs are a "cinch" for DRESSER Couplings

1

For Rapid Takedowns

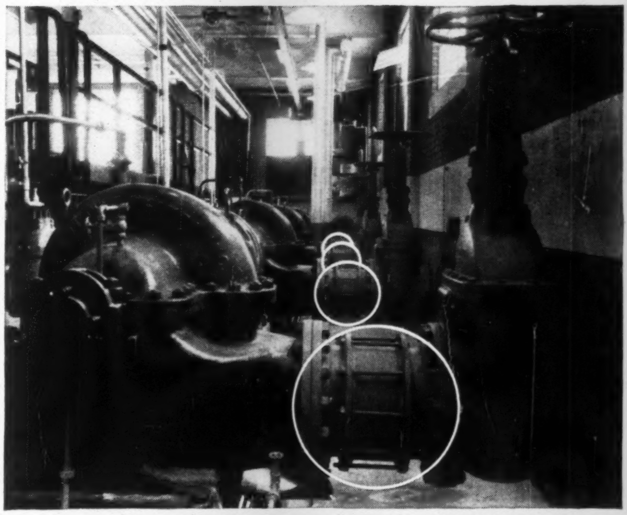
When piping on this huge industrial furnace manifold is removed for periodic cleaning of burners, down time is cut to a minimum. A few turns of a wrench disengages each of the over 100 Dresser Style 65 Couplings. They are easily reinstalled.



2

For Absorbing Vibration

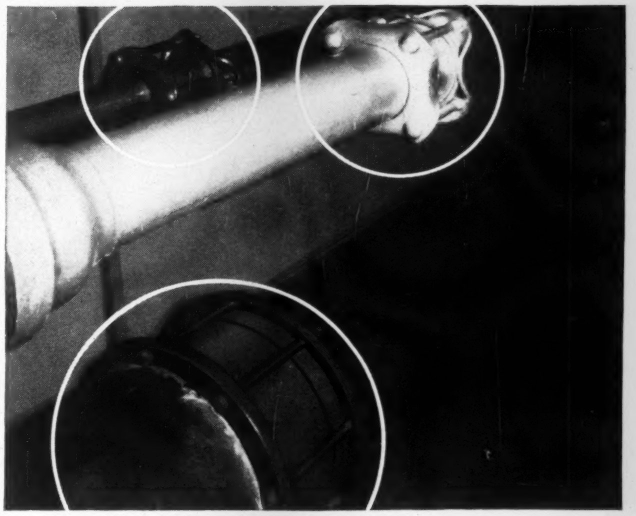
No matter how much these pumps vibrate, the Dresser Style 38 Couplings stay permanently tight. They're equipped with Dresser gaskets which absorb vibration, reduce noise. Style 38's are available for plain-end steel, cast iron or other pipe. Wrench-installed in but two man-minutes per bolt.



3

For Give-and-Take Flexing

At expansion joints in walls, anchored lines carrying liquids or gases must have joints that will *absorb* pipe movements. So Dresser Style 38 Couplings are used. They have resilient rubber gaskets that absorb expansion-contraction, yet stay bottle-tight and maintenance-free.



For fast, easy, sure pipe joining, see your local piping supplier for Dresser Couplings, Ells, Tees, Adapters, etc.

DRESSER®

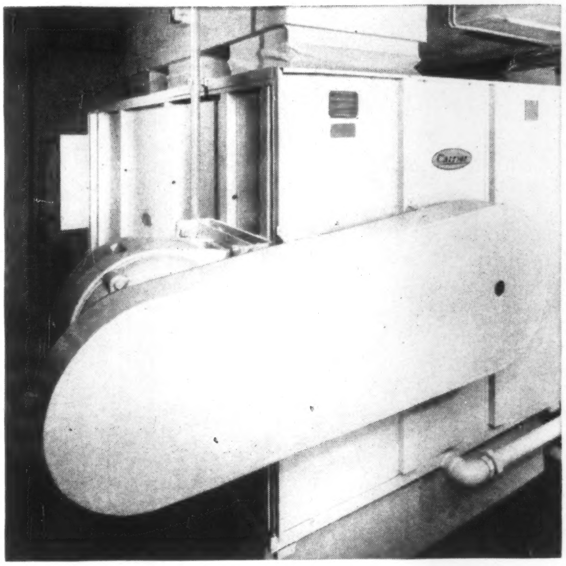
Dresser Manufacturing Division
79 Fisher Ave., Bradford, Pennsylvania
In Canada: Toronto and Calgary.

ONE OF THE DRESSER INDUSTRIES

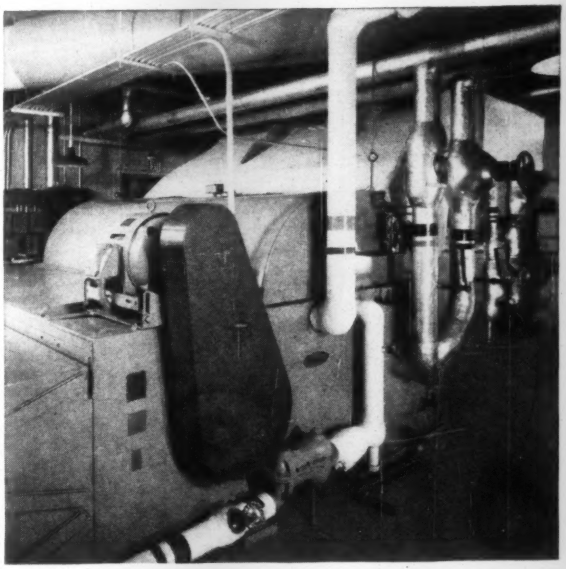
BETTER AIR CONDITIONING FOR EVERYBODY Carrier EVERYWHERE

Which central air conditioner is best for a building?

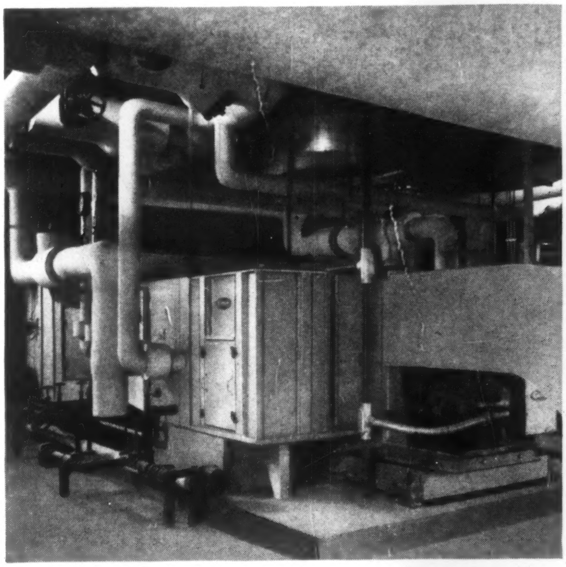
That depends on the building. The size, the purpose,
the climate and the construction can make a big difference.
No one type is best for all buildings. That's why Carrier
offers you such a wide selection of air conditioners.
The four system Weathermaker units shown on the opposite page are
only a few of many Carrier Air Conditioners. Each, however,
is designed to provide unique advantages under specific conditions.
For complete information, call your nearest Carrier office.
Or write Carrier Corporation, Syracuse, New York.



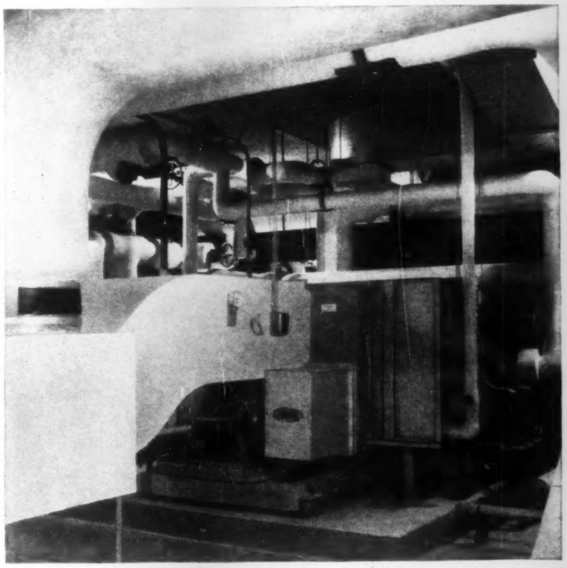
For large open areas, this Carrier Weathermaker* is a good way to condition and distribute air. Using remote sources of refrigeration and heating, it provides cooling, dehumidifying, heating, humidifying, filtering and circulation. Floor or overhead mounting, front or top fan discharge. Nine sizes with a wide choice of coils for direct expansion, chilled water or brine and steam or hot water. Capacities: 1.5 to 100 tons, 400 to 23,000 cfm.



For areas affected by changing loads, this Carrier Zoning Weathermaker is an excellent answer. Multiple mixing dampers connected to hot and cold air plenums permit varying temperature of air supply to each zone. Five sizes, with a wide choice of coils for direct expansion, chilled water or brine and steam or hot water. Uses remote sources of refrigeration and heat. Capacities range from 10 to 80 tons and 2500 to 16,400 cfm.



For multi-story, multi-room type buildings, this Carrier Weathermaker is right for applications employing high-velocity air distribution. Functional components are factory-engineered into a compact assembly complete with insulated fan and coil casing, direct expansion or brine cooling coils, steam coil, recirculating water pump and motor, sprays, eliminators, etc. Capacities range from 30 to 150 tons and from 6500 to 21,000 cfm.



For interior zones, this Carrier Weathermaker is ideal for a system requiring the handling of conditioned air at relatively high duct pressures. Fan and motor have self-contained isolated mounting. Unit has cooling coil, Class III fan, isolated base and a casing enclosure that contains all necessary insulation and accesses. Compact, vibration-free, accessible and serviceable. In three sizes ranging from 30 to 100 tons, 6500 to 23,000 cfm.

*REG. U. S. PAT. OFF.

KENNARD Engineered
COOLING COILS
HEATING COILS
AIR CONDITIONING BLOWER UNITS
MULTI-ZONE AIR CONDITIONING UNITS
HEATING AND VENTILATING BLOWER UNITS
SPRAYED COIL DEHUMIDIFIERS
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EVAPORATIVE CONDENSERS
KENNARD CORPORATION

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AIR CONDITIONING EQUIPMENT

Manufacturers of quality air conditioning equipment for discriminating contractors, consulting engineers and architects.

- ○ COOLING COILS
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- ○ AIR CONDITIONING BLOWER UNITS
- ○ MULTI-ZONE AIR CONDITIONING UNITS
- ○ HEATING AND VENTILATING BLOWER UNITS
- ○ SPRAYED COIL DEHUMIDIFIERS
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- ○ COOLING TOWERS
- ○ EVAPORATIVE CONDENSERS

Write for such bulletins or catalogs as you need.

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Representatives in all principal cities

IF IT'S A "MOTORPUMP" IT HAS A BUILT-IN

Reputation

One sure way to minimize costly call-backs
on air conditioning pump installations is
to start out with a unit you *know* will stand
up on the job without need for
excessive maintenance.

By standardizing on Ingersoll-Rand Motorpumps you are
offering your customers modern, efficient pumps
designed specifically for air conditioning systems. Today,
on all types of installations, thousands of
Motorpumps are delivering the maximum in efficient,
trouble-free operation.

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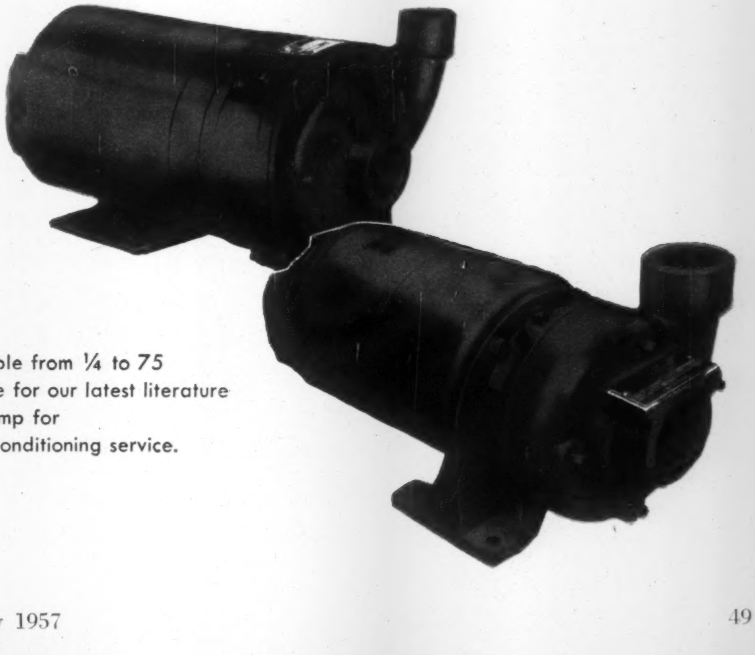

Motorpumps are available from ¼ to 75
horsepower. Write for our latest literature
covering the Motorpump for
air conditioning service.

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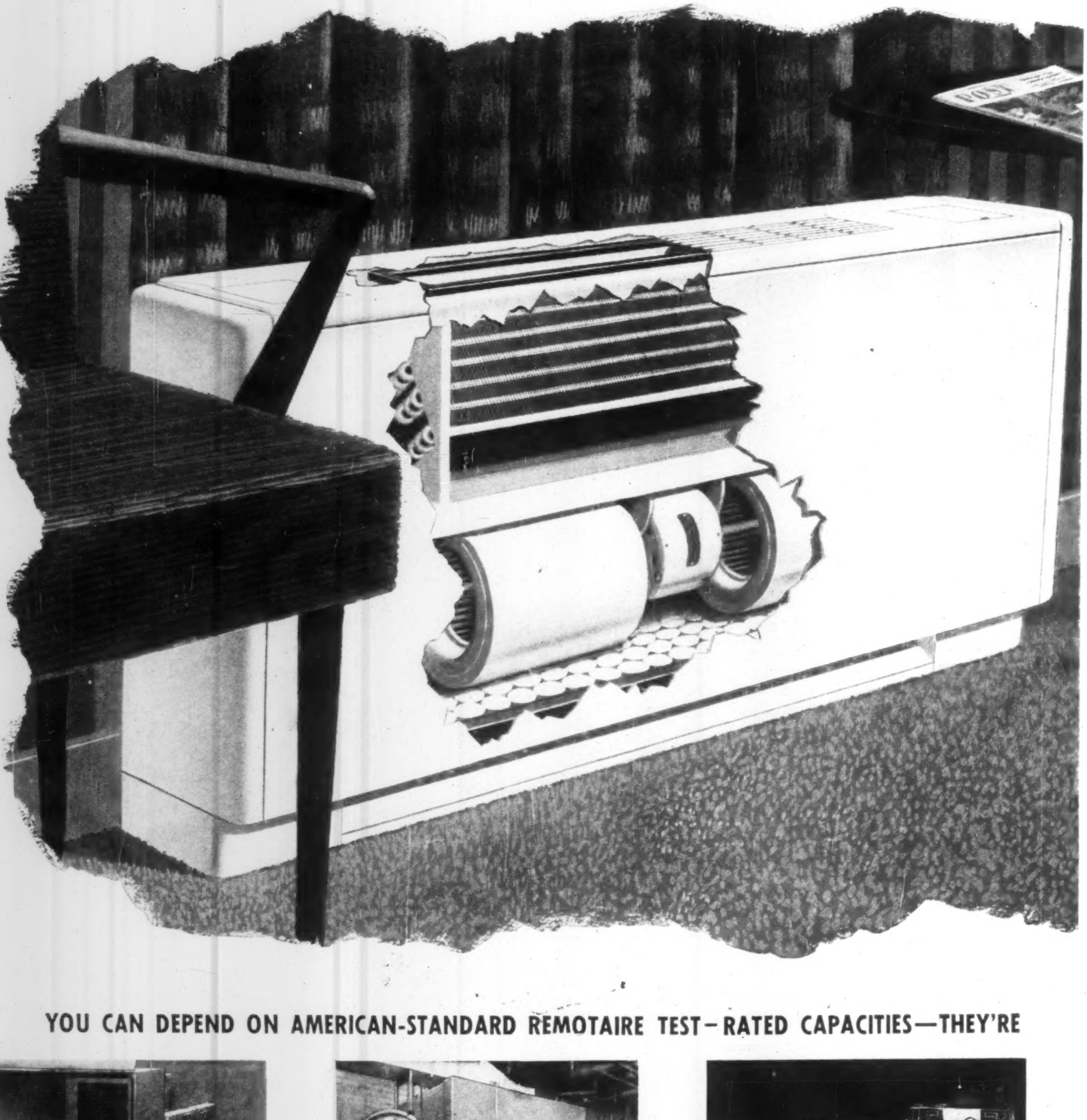
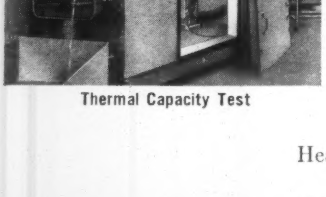
New AMERICAN-Standard

in three models... four sizes for your

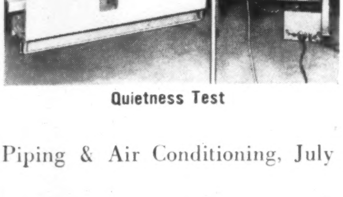


YOU CAN DEPEND ON AMERICAN-STANDARD REMOTAIRE TEST-RATED CAPACITIES—THEY'RE

Air Capacity Test



Thermal Capacity Test



Quietness Test

9"-thin air conditioners

year 'round cooling-heating jobs

TEST-RATED
by
AMERICAN-Standard

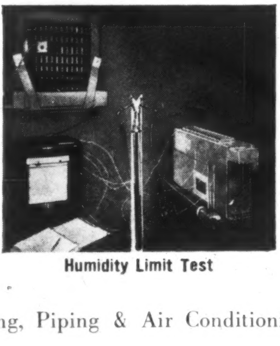
Now year 'round cooling and heating units have been squeezed to an amazingly thin 9". Using the New Vertical Remotaire units as part of a compact boiler-chiller water system, you can meet the most demanding requirements. Here's why.

You can recess these new conditioners into today's thin exterior walls. Yet even installed free-standing, they are out of the way. To building owners and managers, this means more rentable floor space. To hotel and motel men, this means more attractive rooms and ease of furniture arrangement. In *any* installation, 9"-thin units mean year round climate control in a bare minimum of valuable space. Individual room temperature control provides the luxury of zoning at no extra cost. And units are whisper-quiet.

A size for every job—New Vertical Remotaire units are made in a full range of three models in four practical sizes for recessed or free-standing installation. All are just 9" thin and 25" low, with convenient left- or right-hand piping connections. Filter is easily removed *without* removing front panel on all units. These are some of the features that make even the toughest jobs a snap to handle with Remotaire units.

Find out how these New Vertical Remotaire units fit into your job planning. Write AMERICAN-STANDARD, PLUMBING & HEATING DIV., 40 West 40th St., New York 18, N. Y.

LABORATORY PROVEN!



Humidity Limit Test

AMERICAN-Standard

PLUMBING AND HEATING DIVISION

Standing ready to serve you!

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Whether you need a small quantity of steel to wind up a job without going back to the mill—or a medium-size quantity to supplement your present supply—your distributor is capable and instantly ready to fill any need. He's truly "at home" with your problem, regardless of its size.

Your local warehouse distributor is indeed the strongest link between the mill and you—an indispensable supply source. And he's never any farther away than your telephone.

Call him for any quantity of Weirkote zinc-coated sheets—Weirzin electrolytic zinc-coated sheets—or hot or cold rolled sheets. You'll be surprised at the scope of the services he offers you . . . courteously and punctually.

WEIRTON STEEL COMPANY

WEIRTON STEEL COMPANY

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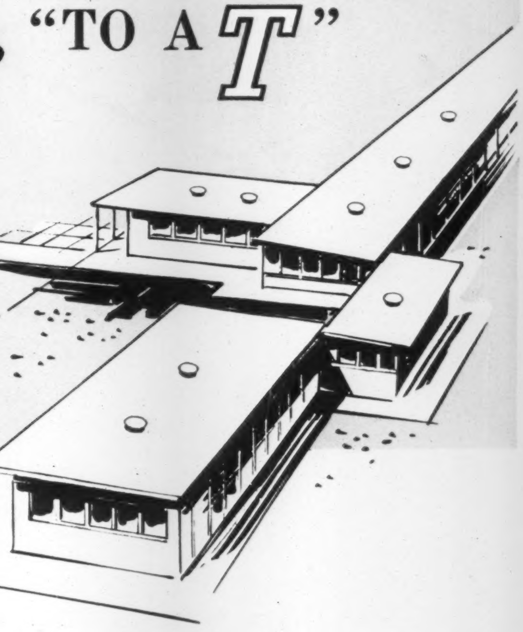
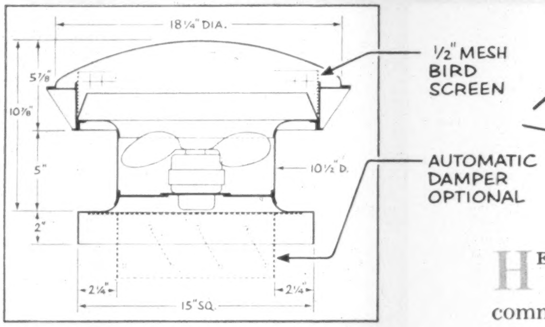
NEW T-TYPE ROOF FANS FIT MANY NEEDS "TO A T"

ALLEN
ENGINEERED VENTILATION



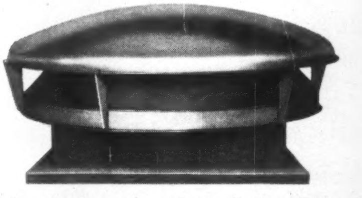


"T-TYPE" SPECIFICATIONS

FAN DIA	MOTOR RPM	CAPACITIES (CFM)			
		.000 SP	.100 SP	.125 SP	.250 SP
10"	1550	420	255	230	110

115 volts, single phase, 9 watt motor

Rated in accordance with the Standard Test Code by the Texas Engineering Experiment Station



Allen low contour "I-Line" Roof Fans:
Direct Drive: 450 to 34,000 cfm.
Belt Drive: 4,000 to 20,150 cfm.

HERE'S the answer to today's architectural needs for low velocity roof ventilation on public and commercial buildings, especially one-story, flat-roof modern structures. The new Allen "T-Type" Roof Fan has a low, attractive silhouette (only 10⅞" high on the 420 model) that blends well with modern exteriors and its design and construction assure high efficiency, easy installation and low maintenance. Standard fabrication is of galvanized steel—aluminum is available. Automatic dampers are optional.

Now . . . one general design in wide range of capacities

Used in connection with the Allen "I-Line" Roof Fans, shown at left, the new "T-Type" now enables architects and engineers to have all ventilators on a roof of the same general design and low contour—from 420 to 34,000 cfm.

See Sweet's for the complete Allen line of roof ventilators —write for data on new "T-Type" Roof Fans

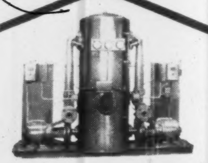
ALLEN ENGINEERED VENTILATION

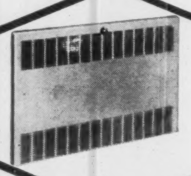
ALLEN COOLER & VENTILATOR, INC.
ROCHESTER, MICHIGAN

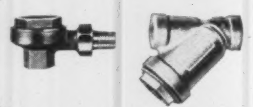
Roof ventilators for every commercial and industrial need • Representatives in principal cities

All Pumps, Convectors and Steam Specialties by DUNHAM-BUSH

ON THIS NATKIN & COMPANY HEATING JOB







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Heating Contractor	Architect	Consulting Engineer

PUMPS

by Dunham-Bush

- VRD65 Duplex Vacuum Pump
- VRDA15 Duplex Vacuum Pump
- CH2030 Duplex Condensation Pump
- CH3030 Duplex Condensation Pump
- CH5030 Duplex Condensation Pump

CONVECTORS

by Dunham-Bush

- Type 'S' Sloping Top Wall Cabinet Convectors
- Type 'R' Recessed Cabinet Convectors
- Type 'TOI' Special Panel Convectors

STEAM SPECIALTIES

by Dunham-Bush

- '1E' Radiator traps
- Float and Thermostatic Traps and Strainers.

Plus Multi-Speed UNIT HEATERS

by Dunham-Bush.

Every day . . . Dunham-Bush "one source—one responsibility" . . . makes more sense to more people who specify and install heating equipment.

At the Cardinal Glennon Memorial Hospital for Children in St. Louis, for example, you'll find *all* pumps, *all* specialties, *all* convectors are by Dunham-Bush.

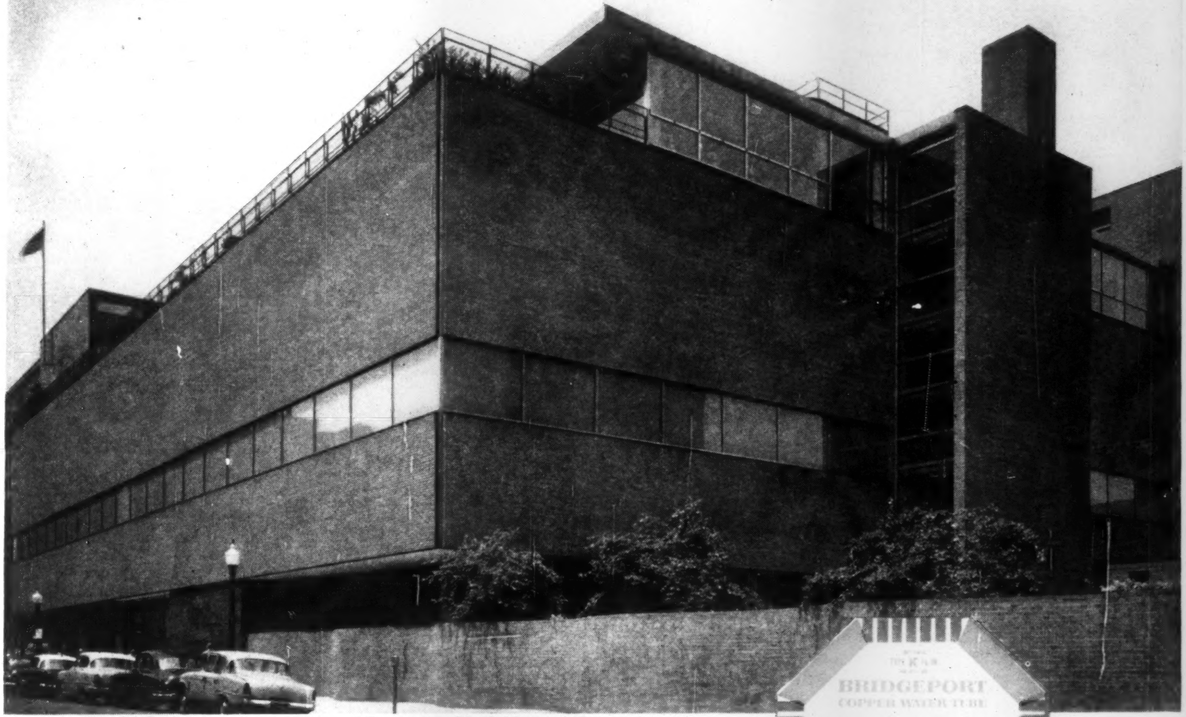
Let Dunham-Bush assist you in your heating plans. Write for details of our complete heating line.

America Looks to DUNHAM-BUSH *for Modern Heating*

DUNHAM-BUSH, INC.

WEST HARTFORD 10, CONNECTICUT, U. S. A.
SALES OFFICES LOCATED IN PRINCIPAL CITIES

ANOTHER BIG JOB USING BRIDGEPORT COPPER WATER TUBE



BRIDGEPORT
COPPER WATER TUBE

Architect: Woodie Garber & Associates; General Contractor: Frank Messer & Sons; Plumbing Contractor: Thomas J. Dyer

...Cincinnati Public Library

Any way you look at it, the new Cincinnati Public Library is impressive. This building is a new idea in library design, and like many other big new projects, its plumbing and heating systems rely on the proved dependability of Bridgeport Copper Water Tube and Pipe—products which will last for the life of the building.

Cincinnati's library is typical of the growing number of big installations for which Bridgeport Copper Water Tube is specified. Bridgeport's nationwide network of leading wholesalers carries the complete Bridgeport line of plumbing and heating products and makes it easy to get *what* you need *when* you want it for *any* size job. Insist on Bridgeport for all your water and drainage tube requirements.

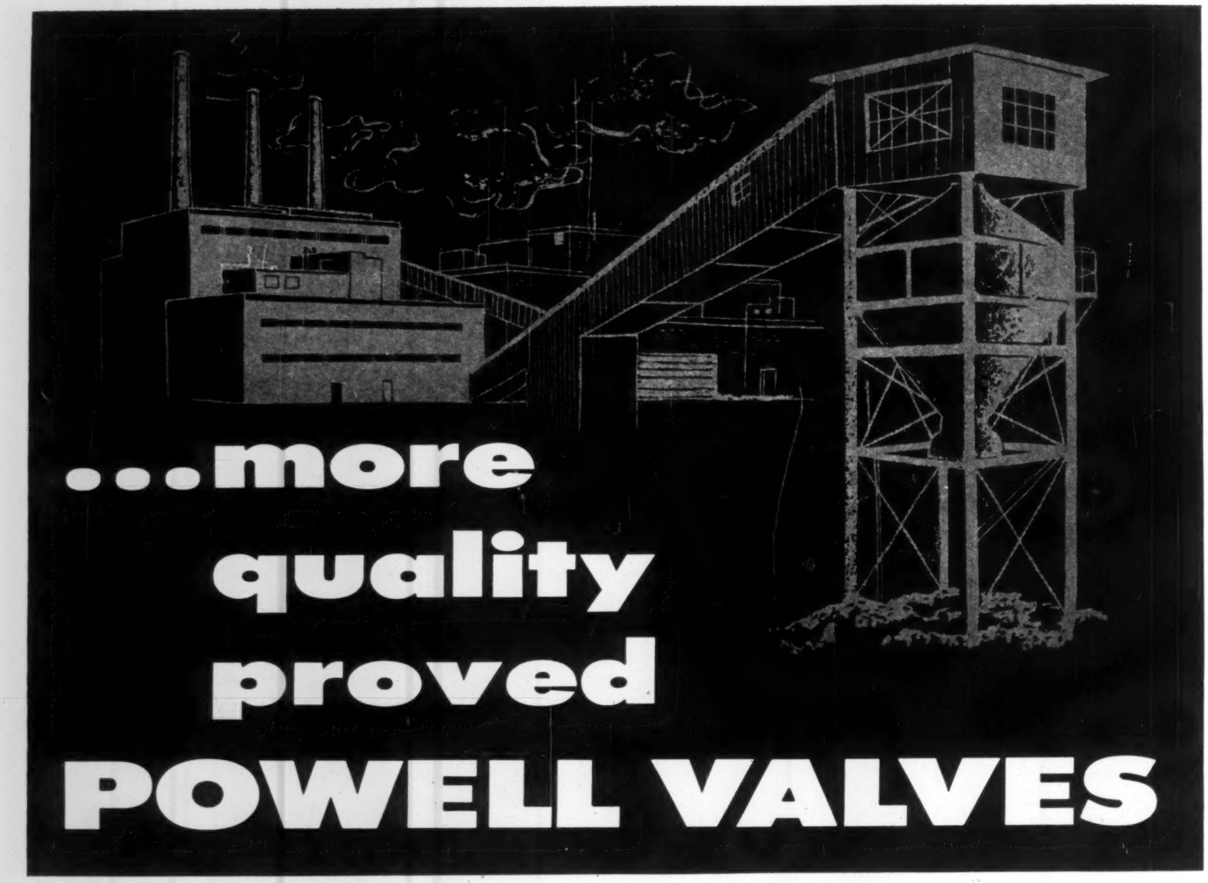
For a better job... install Bridgeport "Either-Way" Sink Traps Exclusive "Either-Way" joint can be used either (1) as a metal-to-metal joint or (2) as a washer joint. This feature insures tighter joints and allows trap to be taken apart as often as necessary without developing leaks. Bridgeport supplies a complete line of traps to meet your specific plumbing code.

for the BIG jobs!

BRIDGEPORT COPPER WATER AND DRAINAGE TUBE

Stocked in conveniently located warehouses from coast to coast. Bridgeport Brass Company, Bridgeport 2, Connecticut
Offices in Principal Cities. In Canada: Noranda Copper and Brass Limited, Montreal

BRASS Bridgeport CO.


...more
quality
proved
POWELL VALVES

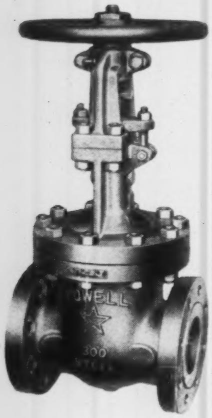

POWELL
300
STEEL

Fig. 3003—Steel O.S.& Y. Gate Valve for 300 Pounds W.S.P.

FIG. 375—Bronze Gate Valve for 200 Pounds W.S.P. Union bonnet and inside screw rising stem.

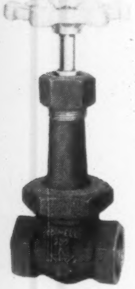
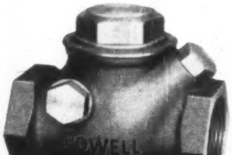


FIG. 1793—Iron Body Bronze Mounted O. S.& Y. Gate Valve for 125 Pounds W.S.P.

FIG. 560—Bronze Regrinding Horizontal Swing Check Valve for 200 Pounds W.S.P.



200 WOG
MS
POWELL
125
WSP

Designed for long life, designed for dependable service

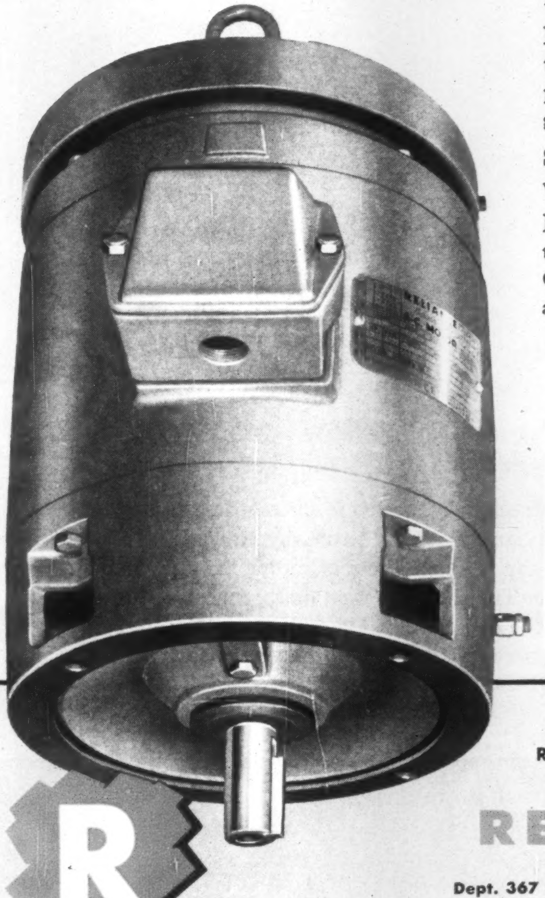
Consult your Powell Valve distributor for all the facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow problem . . . there is a Powell Valve to solve it.

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR

NEW RELIANCE P-BASE MOTORS

Designed for outdoor and indoor installations

THESE RELIANCE FEATURES offer you the best motor for your pump installations.



Totally-Protected, weather tight construction—Corrosion-proof cast iron housing and sealed conduit box with threaded inlet locks out water, dust and foreign matter.

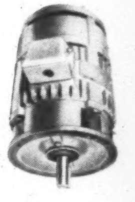
Perfect pump seating—True fit machined motor flange mates perfectly with pump flange, eliminating wear from misalignment.

Life long bearing protection—Special oversized thrust bearings designed for vertical operation are protected with Metermatic lubrication; you can't grease 'em wrong.

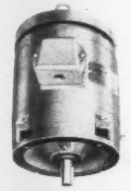
Shaft sealed—Neoprene shaft slinger protects windings from foreign matter creeping up the shaft.

Enclosures for every application—Protected, totally-enclosed, and explosion-proof, Cl. I Gr. D, Cl. II Grs. E, F, & G enclosures available, 1-30 hp. all electrical characteristics.

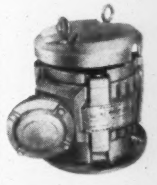
B-1530



Totally-Enclosed, Corrosion-Proof



Protected



Explosion-Proof
Cl. I, Gr. D
Cl. II, Grs. E, F, & G

Write for bulletin B-2502 and check the facts on why Reliance Totally-Protected P-Base Motors are your best buy.

RELIANCE ELECTRIC AND ENGINEERING CO.

Dept. 367 A, Cleveland 17, Ohio • Canadian Division: Welland, Ontario
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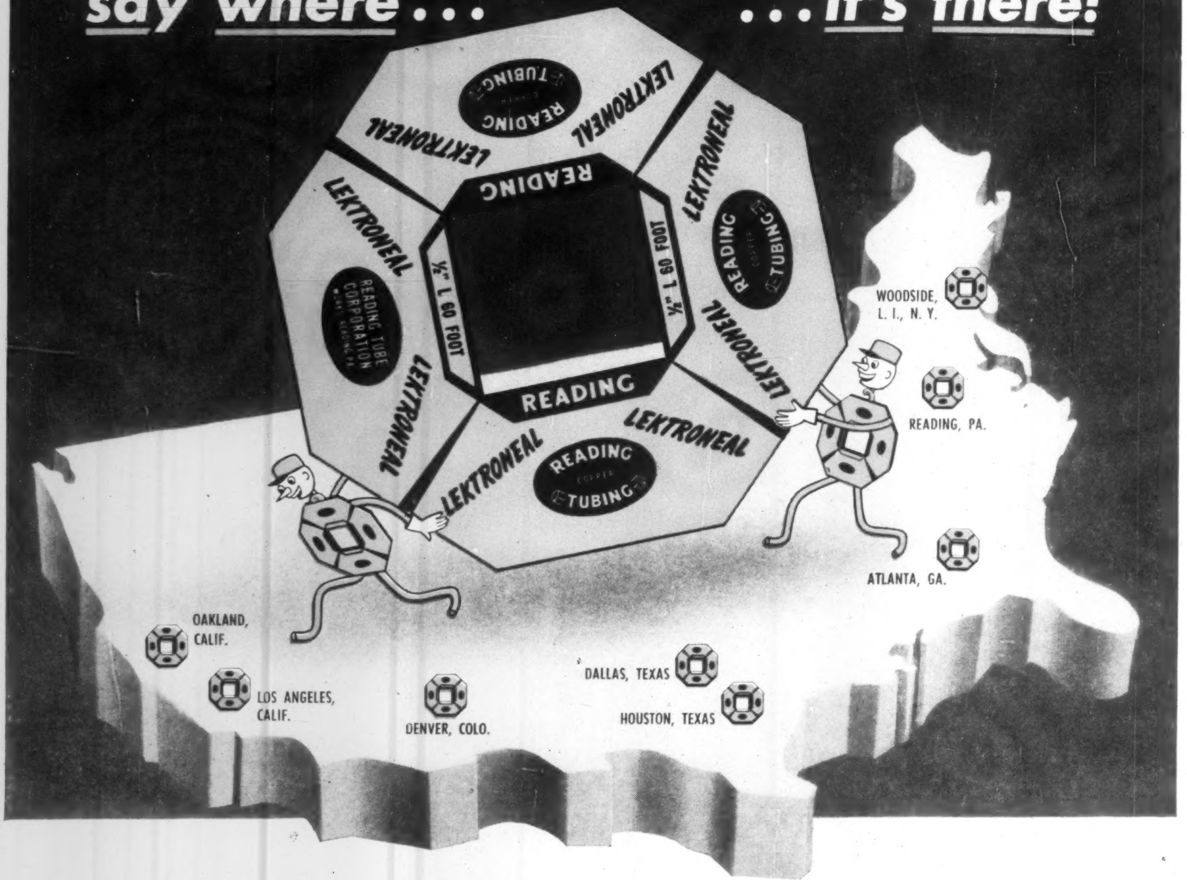
READING COPPER TUBE

say where . . . ***. . . it's there!***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READING TUBE CORPORATION
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DALLAS, TEXAS
HOUSTON, TEXAS

Reading Tube depots are strategically located from coast to coast, so that there's always one within easy reach of your warehouse. That's why you can always be sure of getting the right amount of Reading Copper Tubing, at the right time, to meet even the most urgent orders. Another reason why more and more wholesalers are making it their business to specify READING Copper Tube.

READING COPPER BRASS TUBE
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Sold Through Wholesalers Only

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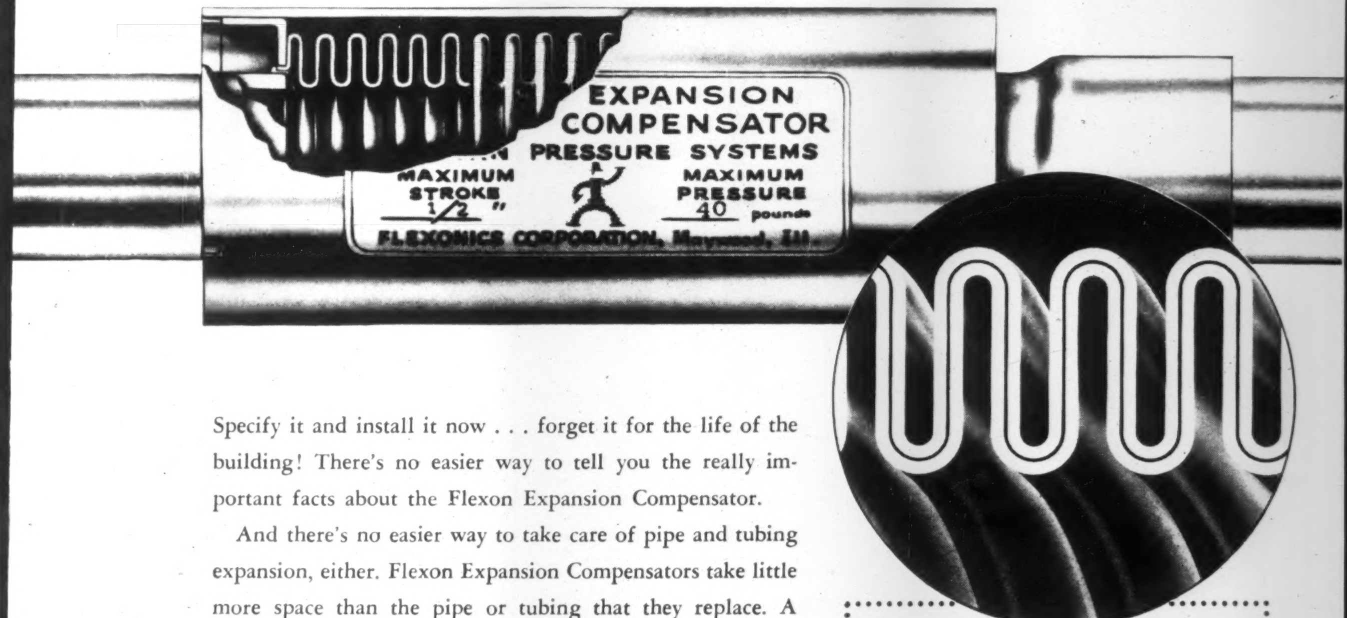
PACKLESS EXPANSION COMPENSATOR

the no-maintenance way to take up expansion in heating lines


EXPANSION
COMPENSATOR
PRESSURE SYSTEMS
MAXIMUM STROKE 1/2"
MAXIMUM PRESSURE 40 pounds
FLEXONICS CORPORATION, Maywood, Ill.

Specify it and install it now . . . forget it for the life of the building! There's no easier way to tell you the really important facts about the Flexon Expansion Compensator.

And there's no easier way to take care of pipe and tubing expansion, either. Flexon Expansion Compensators take little more space than the pipe or tubing that they replace. A mechanic can install one in minutes. Thousands of installations have proved them.

Standardize on this simple specification: Flexon Expansion Compensators for horizontal and vertical lines — Model L for low pressures — Model H for higher pressures. Write today for design and cost data.

The inside story

2-PLY

CONSTRUCTION

The bellows is fabricated from two plies of specially-rolled metal to combine strength with flexibility. Bronze bellows for Model L; stainless steel for Model H.

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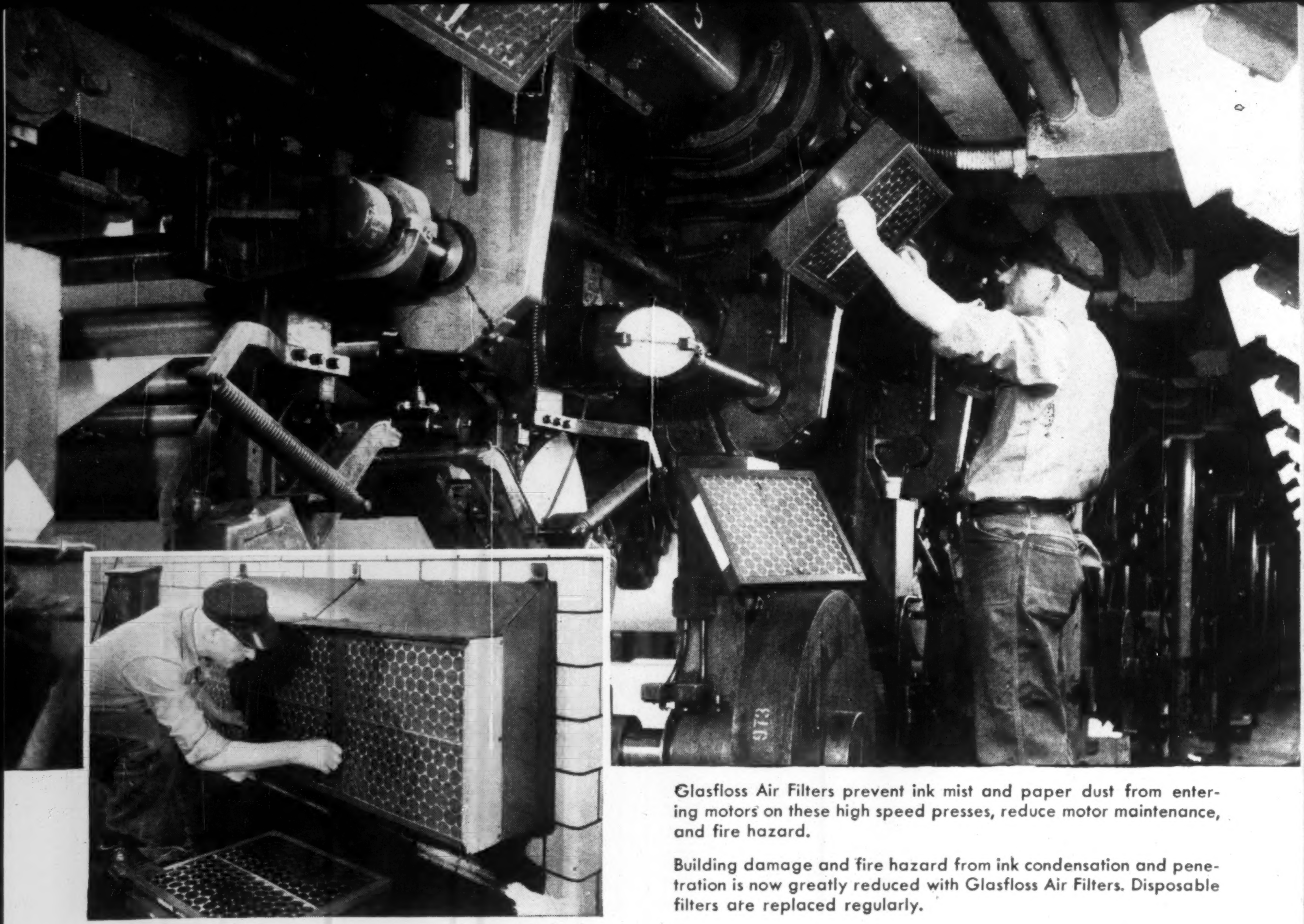
EXPANSION JOINT DIVISION • 1391 S. THIRD AVENUE, MAYWOOD, ILLINOIS

EXPANSION JOINTS | METAL HOSE | NON-METALLIC HOSE | BELLOWS | AIRCRAFT COMPONENTS



Glasfloss Air Filters prevent ink mist and paper dust from entering motors on these high speed presses, reduce motor maintenance, and fire hazard.

Building damage and fire hazard from ink condensation and penetration is now greatly reduced with Glasfloss Air Filters. Disposable filters are replaced regularly.

Glasfloss* Air Filters lessen press maintenance, reduce ink mist hazard at Rochester Times Union

The Rochester Times Union, Rochester, N.Y., had two serious problems common to most newspaper plants, according to Mr. Arnold J. Cunningham, the newspaper's building superintendent.

1. Ink mist and paper dust from 15 press-unit drive motor intakes required the cleaning of internal motor parts every three months. This caused production delays, and thorough cleaning was not always possible.
   Solution: Glasfloss Fiber Glass Air Filters were installed on special frames. Now motor cleaning is done only once every six to eight months, and less time is required. Light vacuuming of filter faces daily allows maximum air intake. Motor operating temperatures are lower and a fire hazard is reduced.
2. Ink condensing inside the air ducts created an extreme fire hazard and ink-spot damage to ceilings and equipment. Paper dust caused extreme surface loading and this impeded the passage of ink mist through the filter.
   Solution: After extensive testing of many filtering devices, Glasfloss Filters proved to be the most satisfactory. Through regular rotation and replacement of filters, the fire hazard has been greatly reduced. Building damage from ink condensation and penetration is very slight. Filtering costs are at a minimum.

GLASFLOSS AIR FILTERS CAN HELP YOU, TOO!

Pittsburgh Glasfloss Air Filters are made from fine, soft fiber glass which provides a greater, more efficient dirt-and-dust-collecting area. Glasfloss Filters are soft and easy to handle; this fiber glass will not splinter or pierce the skin.

Get top results with Glasfloss Air Filters. Write for the name of your nearest Glasfloss distributor. *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pennsylvania.*

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*Trademark

GLASFLOSS FILTERS ARE A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

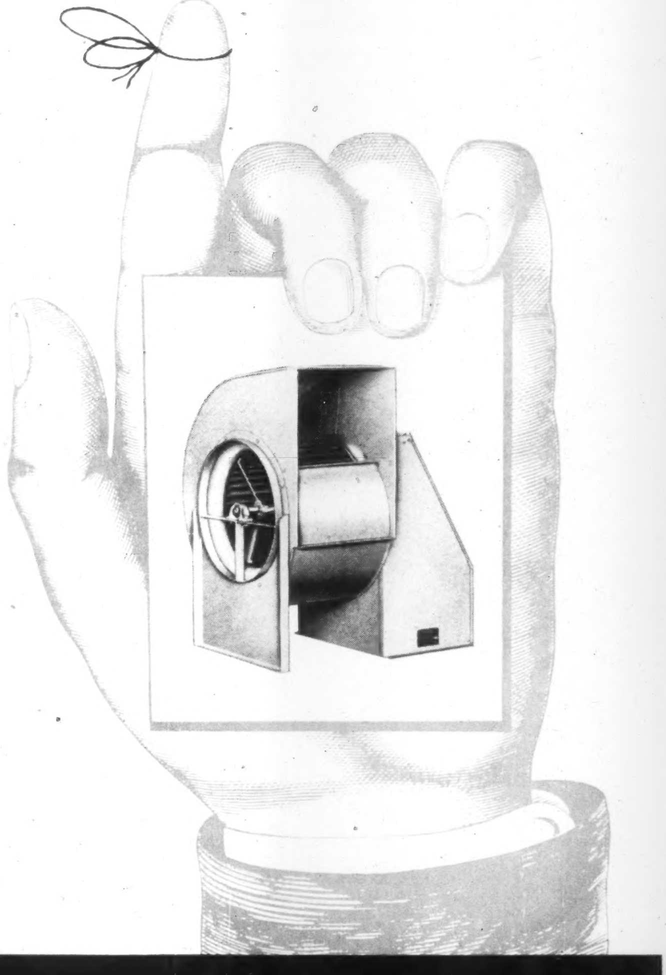
Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh and St. Louis

FIBER GLASS

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS

PITTSBURGH PLATE GLASS COMPANY

we remembered "the forgotten fan"



High on a windy roof, "the forgotten fan" takes a year-round heavyweight beating from wind and the weather . . . frequently breaks down due to lubrication neglect. In times gone by, expensive repair or replacement was the only answer.

That was yesterday. Today, Utility has available a full series of sensibly engineered Enclosed Drive Blowers designed for outdoor service. All motors and drives are completely enclosed to seal them forever against dirt and moisture, protect them forever against drastic temperature changes. Lubricated for life with pre-greased, permanently sealed ball bearings, costly breakdowns from lack of proper maintenance just don't happen!

Next project, why not specify a Utility Enclosed Drive Blower for roof installation tailored to the job? They cost no more and save expensive and cumbersome sheet metal work. You'll find that however tough "topside" the going gets, Utility blowers can take it — day in, day out — year after faithful year.

A DIVISION OF UTILITY APPLIANCE CORP.

UTILITY FAN CORP.

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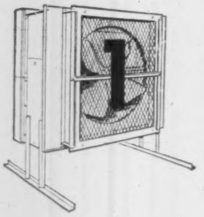
Manufacturers of heavy and standard duty blowers for heating, air conditioning and ventilating installations. Producers of blowers and blower parts for original equipment manufacturers. Write for catalogue data.

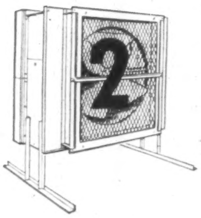
ONLY KRAMER UNICON + WINTERSTAT* GUARANTEES ALL 4

MAXIMUM LIQUID PRESSURE AT EXPANSION VALVE IN WINTERTIME



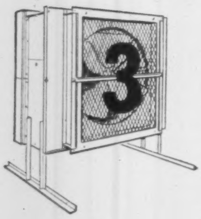
Only the Kramer UNICON plus WINTERSTAT guarantees the full refrigerant pressure *at the expansion valve* for full cooling capacity — even at below 0°F outdoors — *automatically!*

MAXIMUM SUMMER CAPACITY WITH PATENTED WINTERSTAT



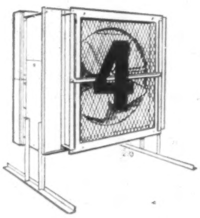
Only Kramer UNICON plus WINTERSTAT guarantees maximum condensing capacity in summer. In hot weather, the patented WINTERSTAT is out of the refrigerant circuit, permitting normal drainage from the condenser without restriction. This assures maximum condensing capacity in summer — *automatically!*

PROMPT DEFROSTING AT ANY OUTDOOR TEMPERATURE



The use of UNICON plus WINTERSTAT makes Kramer THERMOBANK the only low temperature system that can guarantee operation and complete defrosting at any outdoor temperature—even 0°F or lower—*automatically!*

IMMEDIATE COMPRESSOR START-UP REGARDLESS OF OUTDOOR WINTER TEMPERATURE



Only Kramer UNICON plus WINTERSTAT (using modification #1) ensures positive and immediate compressor start-up with pressurestat operating the system, regardless of outdoor winter temperatures at the UNICON and regardless of length of compressor lay-off — *automatically!*

**UNICON is a remote type air-cooled condenser* *WINTERSTAT is a year 'round automatic head pressure control*

WRITE FOR BULLETIN U-210-L

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43 YEARS OF CONTINUOUS ACHIEVEMENT IN HEAT TRANSFER

NOVELTY breaks the

Life Quality Price

barrier

Now—Novelty's products offer Longer Life—Higher Quality—at Lower Prices.

Novelty has combined its fifty years of building unfired pressure vessels and storage tanks—with ten years of developing a complete line of Novelon Linings to bring you vessels that will give you corrosion protection available heretofore only with expensive alloys and clads.

Next time you specify Hot Water Generators, Storage Tanks, Heat Exchangers or special fabricated systems—specify Novelty to break the LQP barrier.

● Specify NOVELTY
THERE'S NO EQUAL

NOVELTY
STEAM BOILER WORKS INC
SUBSIDIARY OF
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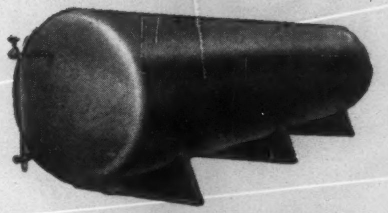
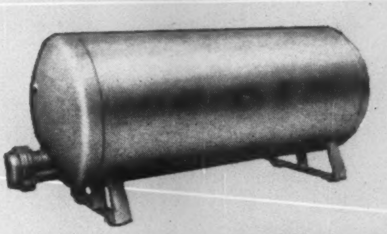
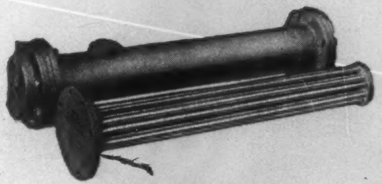


Storage Tanks



Hot Water Generators



Heat Transfer Equipment

Special Fabrication

NOVELTY STEAM BOILER WORKS, INC.
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"Not only is this sheet easier to work...

WHEELING
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but it takes every bend and fold...

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without chipping or flaking, because...

WHEELING
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Wheeling SofTite® has the tightest zinc coating yet produced"

What makes Wheeling SofTite different from other galvanized sheets? Just ask any sheet metal man or air conditioning contractor who has tried them.

They'll tell you that Wheeling SofTite takes every bend, every crimp, every tortuous fold without ever cracking or peeling. That's because SofTite is ductile, so it's easy to work. At the same time it has the tightest zinc coating yet produced. That's why SofTite ducts look so good, last so long, and give service above the call of duty.

If you would like to enjoy all these advantages, make a note right now to try Wheeling SofTite.

Call your Wheeling industrial supply distributor, the Wheeling sales office nearest you, or write Wheeling Steel Corporation, Wheeling, West Virginia.

IT'S WHEELING STEEL

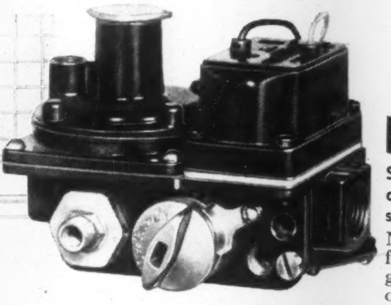
WHEELING STEEL

District Sales Offices—Atlanta, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Detroit, Houston, New York, Philadelphia, St. Louis, San Francisco, Wheeling

OUR CHALLENGE STANDS: ANYTHING THAT CAN BE MADE OF STEEL SHEETS CAN BE MADE OF WHEELING SofTite GALVANIZED SHEETS

LAST WORD FROM AP *first name in quality controls*

NOW! A KEY LINE OF GAS CONTROLS



NEW!

Series 5010 gas control for clothes dryers, wall heaters, space heaters, trailer heaters.

New compactness never before possible! *The* automatic gas control that *fits* where others can't. Available with magnetic operator . . . pressure regulator is optional. Straight-thru (side or bottom) outlets. Built-in "A" and "B" cocks or flow interrupter, safe lighting, 100% safe shut-off. Complete kit also includes — choice of two thermostats, transformer, wire and staples. Ask for descriptive bulletin.

NEW!

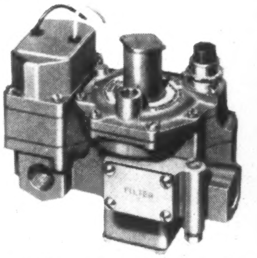
Series 5030 normally open electro-magnetic gas "Oven-Tender" control for clock-controlled ovens.

Smaller than any in the field — no bigger across than a fine watch. Quieter than conventional solenoid. Silent snap action. Mounts in any position. Variety of inlets and outlets for pipe or tubing. For all gases. Write for descriptive bulletin.

Never before have gas appliance manufacturers been offered such a line as this: 4 gas controls so versatile in application — so compactly engineered — they outmode all others in the field.

To gas appliance dealers this means more built-in competitive advantages — on a broader range of products than ever before! You sell *truly automatic control* — plus a number of sales-clinching thermostatic accessories perfected by extensive research of Controls Company of America.

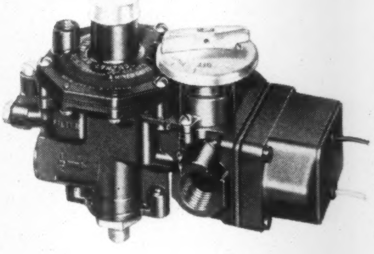
You sell easier lighting, operation and shut-off . . . and A-P's single-source responsibility backs every control sold.



NEW!

Series 5250 gas furnace control — also best for unit heaters. Complete with electro-magnetic operator.

Features a flow interrupter for summer shutdown. Has built-in pressure regulator — available for use with LP gas. Easy conversion without breaking pipe connections. Assures 100% safe shut-off . . . safe lighting. Choice of outlets. Write for bulletin.



VERSATILE!

"55" gas control . . . four interchangeable thermostats for any heating need.

Electric and non-electric types. Magnetic operator (as above), electric thermostat, modulating and modulating-snap thermostats. Best for space heaters, small furnaces, unit heaters. AGA, UL and CSA listed.

CONTROLS COMPANY OF AMERICA

Manufacturers of A-P CONTROLS

2416 N. 32nd Street, Milwaukee 10, Wis.

Controls That Make Modern Living Possible

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COPPER WATER TUBE
PHELPS DODGE COPPER PRODUCTS
75
NATIONAL ASSOCIATION OF PLUMBING CONTRACTORS

For Mine-to-Market *Dependability*

That Builds Your *Reputation . . .*

Specify PHELPS DODGE COPPER WATER TUBE

Packaging that's easy to stock and use.

Dependable quality that starts with highest grade copper from Phelps Dodge's own open-pit mines and is carefully controlled during fabrication.

Color-coding of tube in straight lengths for quick identification in the stockroom and on the job.

Mill depots strategically located to service distributors without delays.

Tube properties that are unsurpassed, including precise uniformity of wall thickness.

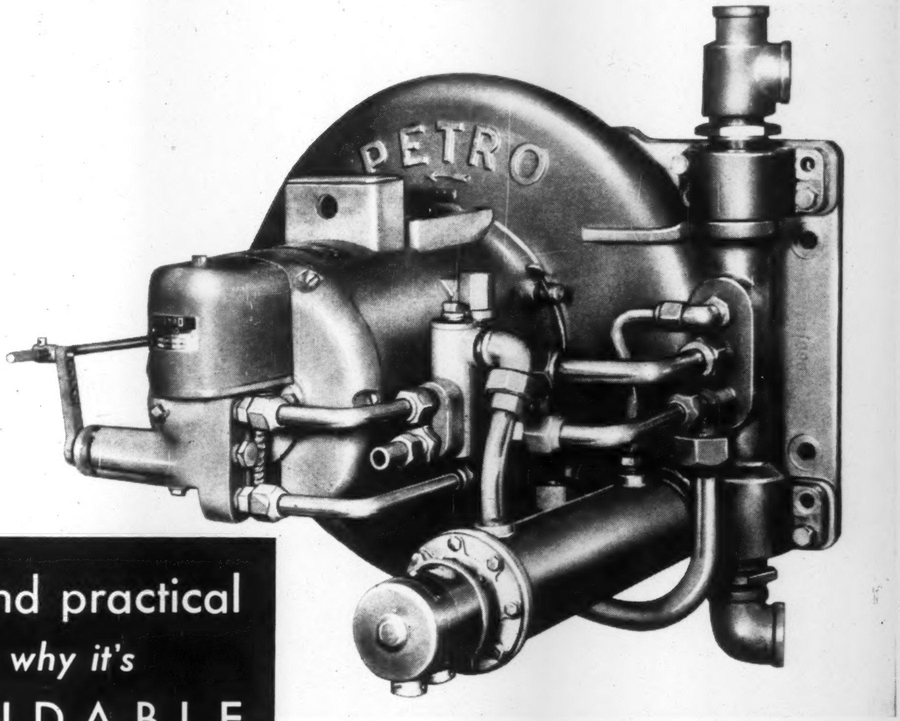
For the name of your nearest Phelps Dodge distributor, write Dept. B4, Phelps Dodge Copper Products Corporation, 300 Park Avenue, New York 22, N. Y.

PHELPS DODGE COPPER PRODUCTS

CORPORATION

NEW YORK, N. Y. • LOS ANGELES, CALIF.

Petro HEAVY OIL BURNER



Simple and practical

that's why it's

DEPENDABLE

Residual oils are low cost fuels. They have higher heat value than light oils, and usually cost less per gallon. But in spite of their economy they are often avoided because they are considered difficult to handle and burn. A moderate change in temperature can change them from a fluid to a sluggish semi-solid.

These heavy oils (Nos. 5 and 6) are easily controlled and burned by the Petro system which is remarkably free from mechanical complexities.

1. A simple oil heater automatically warms the oil to a point where a common viscosity is reached. (Fuel oils approach this at a temperature of about 160 degrees).

2. An automatic valve passes the oil to the nozzle only when it is warm enough for accurate metering and instant ignition.

This is the basis of the Petro "Thermal Viscosity Principle." The Petro burner isn't fancy; it isn't temperamental; but it *stays on the job.*

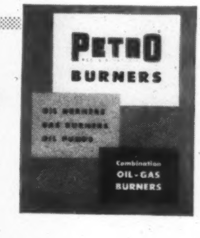
In spite of its ruggedness, the Petro heavy oil burner is precision equipment which will operate efficiently with any type of automatic control system.

Petro oil burners have been the steady, reliable work horses in heavy oil firing for over 50 years. They have saved their owners untold thousands of dollars in low fuel and maintenance costs.

For further information, please mail coupon.

Send for this PETRO® catalog

Over 50 years of leadership in automatic heating and power equipment



PETRO, 3530 W. 106th Street, Cleveland 11, Ohio.
In Canada, write to 2231 Bloor St., W., Toronto, Ontario.

Please send me literature and specification sheets on the money-saving Petro forced draft firing system.

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Company____________________

Address____________________

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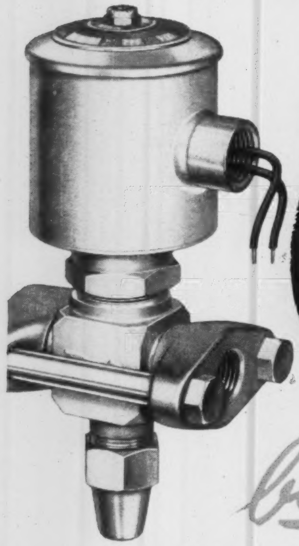
PEAK PERFORMANCE SOLENOID VALVES

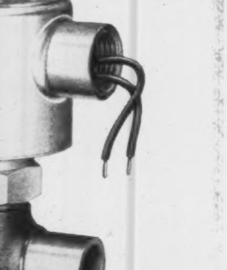


with the POWER PACKED BLUE SEAL COIL!

because . . . it is layer wound with a cross woven insulating layer of cotton thread between each layer of magnet wire, thereby minimizing coil burn out.

After Winding . . . it is twice dipped in high temperature insulating and moisture repellent varnish and baked after each coating.

Its final Blue Seal protective coat and bake assures a perfect moisture proof seal.



***Plus* all these additional SPORLAN engineering features . . .**

Simplicity . . . few parts . . . sturdy take apart construction . . . floating type stem and plunger assembly . . . tight closing . . . internal parts precision machined. All large capacity pilot piston operated solenoid valves are equally applicable to Refrigerants 12, 22, and Carrene-7. Synthetic seating originally introduced by SPORLAN in 1947 has now been incorporated in the design of all pilot piston solenoid valves and in some direct connected models. 3 size Blue Seal Coils fit the complete line of SPORLAN Solenoid Valves thereby affording greater interchangeability of coils. Large capacity sweat type connection valves are assembled hand tight . . . saves valuable time in removing internal parts before installing valves in the system. A universal mounting bracket fits all valves.

and Remember . . . *for Peak Performance on all installations Buy SPORLAN Right Down the Line . . . Catch-Alls . . . Solenoid Valves . . . Thermostatic Expansion Valves . . . and Refrigerant Distributors.*

SPORLAN VALVE COMPANY

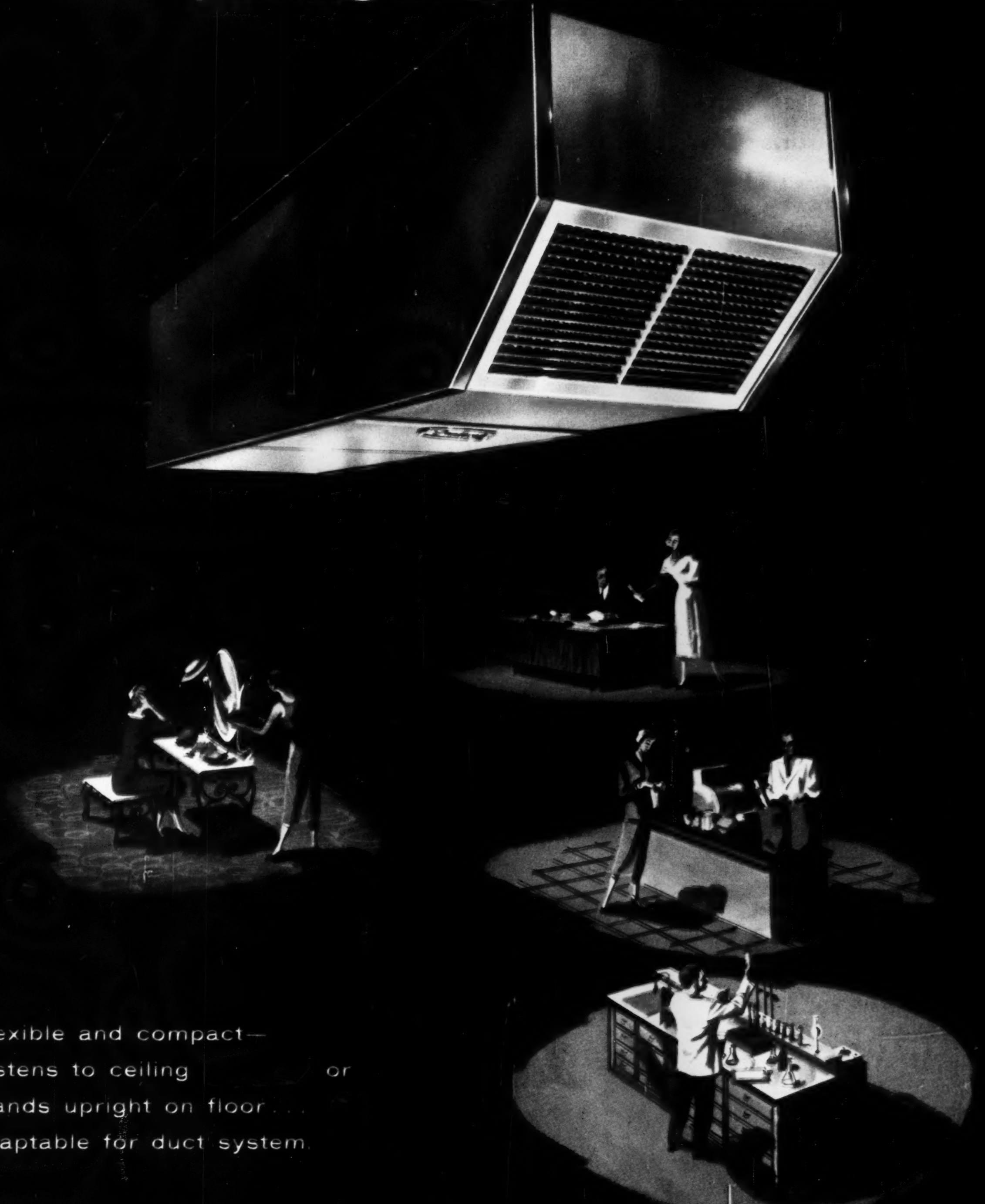
7525 SUSSEX AVENUE   ST. LOUIS 17, MO.

EXPORT DEPT. AD. AURIEMA, 85 BROAD ST., NEW YORK 4, NEW YORK

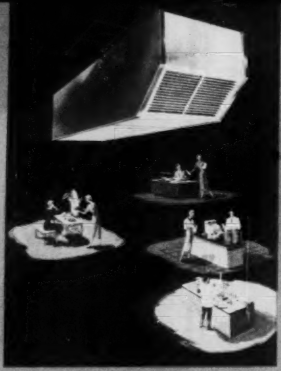
the quality tells . . . the quality sells

new JANITROL AIR COOLED

packaged air conditioner

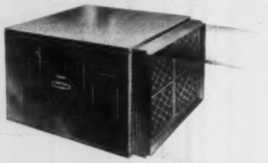


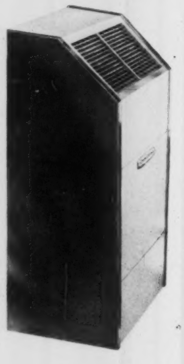
Flexible and compact—
fastens to ceiling or
stands upright on floor . . .
adaptable for duct system.



Versatile new JANITROL packaged waterless cooling conditioner

Makes installation easy, even in those "problem" locations—brings new efficiency and beauty into the picture, too!





Nothing in air conditioning matches the versatility and performance of this brilliant new Janitrol "packaged" air cooled cooling conditioner.

It adapts itself to most every installation situation you'll ever face in commercial and light-industrial applications . . . because it can be fastened to the ceiling or positioned vertically on the floor, and is readily adaptable for use with a duct system. Either way, big savings in space result. Waterless operation eliminates time-consuming plumbing, allows operation in areas of water scarcity. And it's as easy on the ears as it is on the eyes, because all moving parts except the blower are contained in the remote, air-cooled compressor unit. Thus operating noises are isolated from the conditioned area.

Now, even more than before, you can count on Janitrol for the right "packaged" conditioner at the right price . . . air-cooled and water-cooled models . . . combination heating-cooling conditioners for year round application. All backed by Janitrol's reputation for quality, dependability and expert technical assistance. Ask your Janitrol representative for full details.

REMOTE COMPRESSOR-CONDENSER UNITS FURNISHED WITH NEW JANITROL AIR-COOLED PACKAGED CONDITIONER

CAPACITIES*

SRA-7	22,000 btu.
SRA-9	35,000 btu.
A-401 & 403	47,500 btu.
SRA-11	58,500 btu.

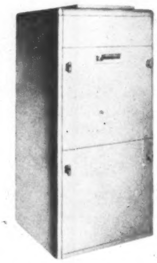
A-603 76,000 btu.

*95° F. Dry Bulb air entering condenser, 80° F. Dry Bulb, 67° F. Wet Bulb air entering evaporator, approximately 400 CFM per 12,000 btu.

ARCHITECTS, ENGINEERS AND CONTRACTORS INFORMATION SERVICE

Write today for complete A.I.A. files on Janitrol cooling and heating in buildings of every type, and for Janitrol specifications service. There's no obligation.

Janitrol SAC and SACF water-cooled conditioners



◄ **Model SAC**—has built-in filters and blower, connects to present duct system.

Model SACF — packaged, console-type unit operates without duct connections. ►

Compact, smartly styled, easily adapted to existing space. Optional 2-stage operation with SAC-60 5 h.p. models. Two separate compressors are provided—a 2 h.p. and a 3 h.p. In mild weather, the 3 h.p. stage controls humidity without overcooling. The 2 h.p. stage turns on automatically when rising temperatures demand full cooling power. Controlled sequence starting. Capacities* 26,800, 36,900 and 63,700 btu.

JANITROL WIN-SUM-MATIC YEAR 'ROUND CONDITIONER

Combines thrifty gas heating, waterless cooling in little as 4½ sq. ft. of floor space. Unique by-pass eliminates heat exchanger resistance on cooling cycle, gives correct air flow for heating and cooling without seasonal adjustments. Air cooled Pride O' Yard unit is low, sleek, efficient . . . shames ordinary "doghouse" models. ADD-ON cooling option —install for heating only, add cooling later. Upflow and downflow models, 100,000 and 140,000 btu./hr. heating, 22,000 to 58,500 btu./hr. cooling capacities*.

JANITROL SRA ADD-ON COOLING

Adapts most any warm air furnace for thrifty, efficient central cooling. Cooling coil mounts in duct, beautiful air cooled Pride O' Yard unit goes outside. Powerful, quiet performance with outside temperatures to 125° F. Easy to install, moderately priced. Waterless operation eliminates plumbing, sewage, water supply problems. 22,000, 35,000 and 58,500 btu./hr. Capacities*.

JANITROL GAS-FIRED DUCT FURNACES

Designed for installation in a duct where the air is circulated by a remote fan. Especially adaptable for industrial heating applications in combination with cooling. Low in cost, save installation time and labor. Unit sizes from 85,000 to 300,000 btu./hr. New 200,000 and 300,000 btu./hr. units may be combined to provide unlimited capacity range.

JANITROL HEATING AND AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORPORATION
COLUMBUS 16, OHIO
In Canada: Moffat Heating & Air Conditioning Division
Moffats, Ltd., Toronto 15

Also Makers of *Surface* Industrial Furnaces, Kathabar Humidity Conditioning, *Janitrol* Residential Heating and Cooling Equipment.

WHY B&G ASME SAFETY RELIEF VALVES ARE *DIAPHRAGM OPERATED!*

B&G Safety Relief Valves feature diaphragm construction because *during an emergency*, a B&G diaphragm operated valve has *much greater opening power* than the "pop" type valve. That's because the effective operating area in B&G diaphragm type valves is *as much as nine times greater!*

This added power enables the valve to overcome the effects of fouling which can occur in any heating system. Foreign materials, such as pipe dope, soldering flux and boiler compounds will sometimes cause adhesion of the disc and seat of any relief valve, requiring additional force to open the valve.

Under *normal* operating conditions, the spring force in both types of valves balances the effective areas. During an *emergency*, the extra area of the diaphragm provides extra power which will open the valve within safe operating pressures.

If, for example, the cementing action of adhesive matter in the system water makes necessary an additional two pounds of force to open the valve, a No. 350 B&G Relief Valve *will open at 31.1 psi*, whereas a "pop" type valve will not open until boiler pressure reaches 40 psi.

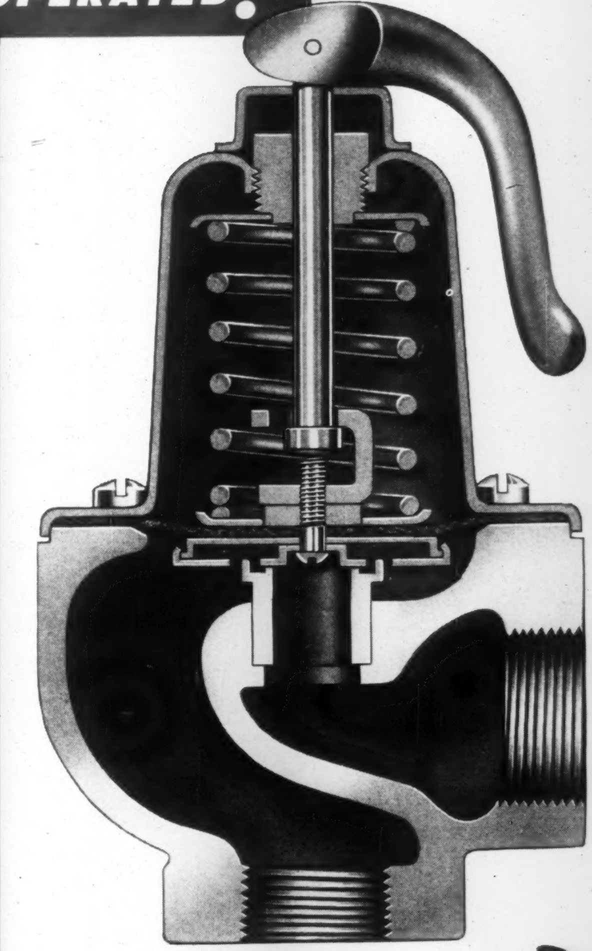
No guides to jam!

In non-diaphragm valves, the disc must be centered over the seat by sliding through close fitting guides. Adhesive materials in the system water may cause cementing between the disc and guide sufficient to prevent the valve from opening at safe operating pressures.

There are no guides to jam in a B&G Relief Valve! The disc is always centered in sealing position by the diaphragm.

Silicone Rubber seat

Silicone is extremely resistant to the effects of high temperatures—will not deteriorate or become deformed through age or use.



No. 250

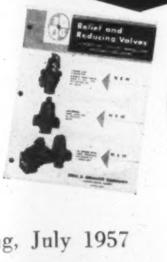
No. 350

No. 1050

No. 4100

WIDE RANGE OF CAPACITIES

B&G ASME Safety Relief Valves are available in capacities from 150,000 to 6,050,000 BTU/hr, with valve settings from 15 to 125 lbs. For complete information send for Bulletin HZ-856.



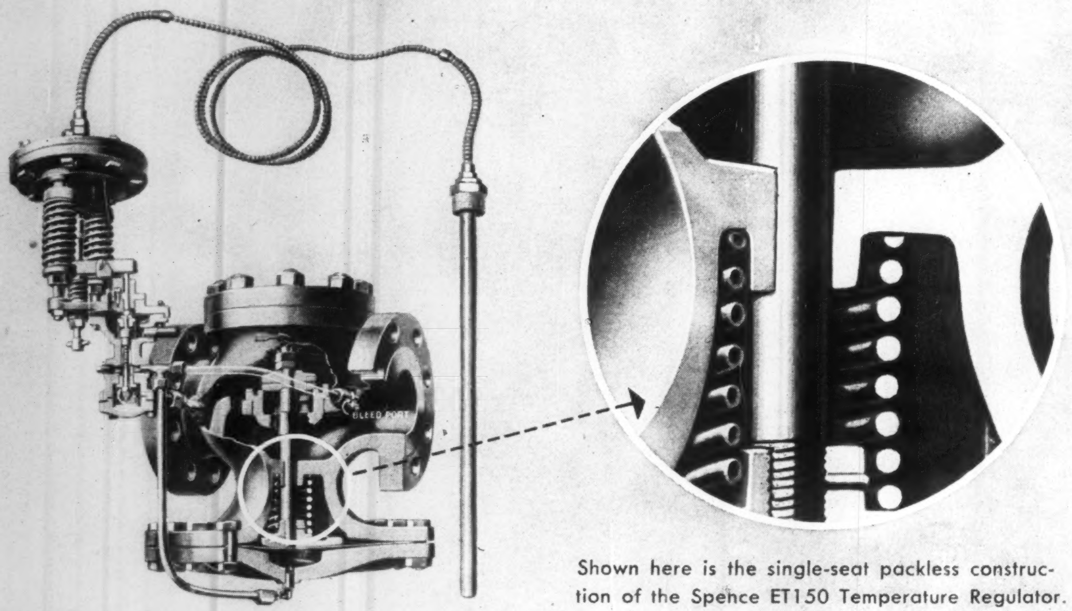
BELL & GOSSETT COMPANY

Dept. EW-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

VALVE TIPS:

Advantages of Packless Construction in Temperature Regulating Valves



Shown here is the single-seat packless construction of the Spence ET150 Temperature Regulator.

One of the biggest headaches in regulating valve maintenance is repacking stuffing boxes.

How often a valve needs repacking, how much time it takes, and the cost of the system downtime all vary with the construction of the regulator and the service it's used for. No matter how you calculate all these variables it's still a headache—and an expensive one.

In the temperature regulator shown above (Spence Type ET150) stuffing boxes are eliminated. This is done by what is known as "balanced" diaphragm construction. You can see in the cutaway drawing that pressure is applied to both sides of the large metal diaphragm. The upper side is exposed to delivery steam pressure and the lower side is exposed to loading pressure applied by the pilot. When the pilot closes, both delivery pressure and loading pressure are equalized through the bleedport and connecting tubing.

This construction not only does away with repacking problems, but it makes possible additional savings as well. For example, you will note in the sectional blow-up that this design eliminates a closely fitted stem and guide. Dirt or other foreign matter doesn't have much of a chance to lodge between these parts and cause sticking.

Another cause of binding or sticking, uneven expansion of closely fitted parts, is also eliminated with this design. In addition, valve stem wear is reduced for the same reason.

Lower maintenance is not the only advantage of this packless construction. Accuracy of regulation is also improved because friction due to a stuffing box, dirt, or uneven expansion is not a problem. The large, *balanced* metal diaphragm is more sensitive to slight changes in pressure.

Guaranteed Not To Wiredraw

If seats and discs are cut by steam (wiredrawn) the loss of steam through these grooves can be another expensive item — directly charged against the regulating valve. Fortunately, you can eliminate these costly leaks by specifying a temperature regulator that is *guaranteed not to wiredraw.*

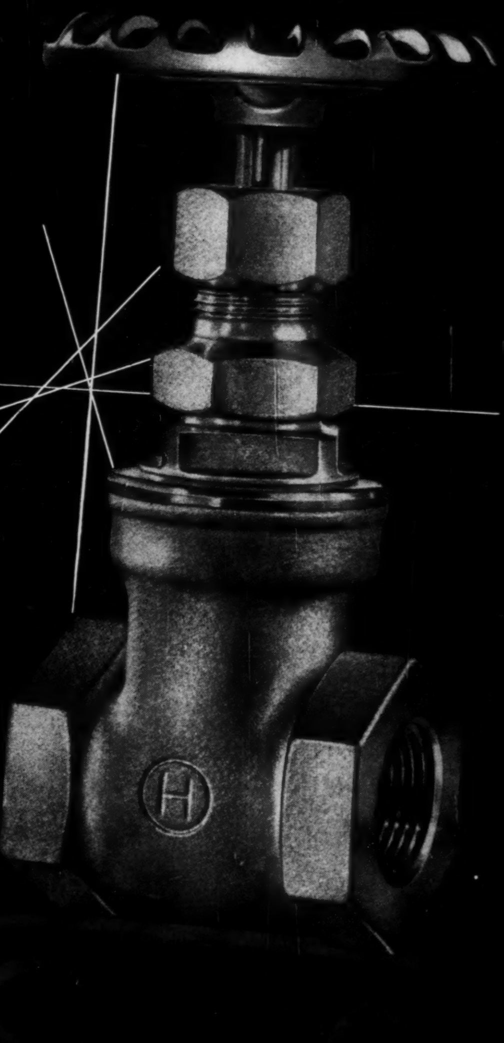
Spence makes such a guarantee because their seats and discs are made of SECO Metal. Over 20 years experience with this special alloy has failed to produce a single case where a SECO Metal seat or disc had been cut by steam. All that's required is an approved strainer located ahead of the regulating valve. Expensive steam leaks just can't happen with this combination of SECO Metal and single-seat design.

If you would like to have more information on Spence Temperature Regulators, drop us a line and ask for Bulletin T150. It gives more detailed information on these and other Spence design features. Piping layouts and helpful information on the installation of temperature regulators are also included. Write for your copy today.

SPENCE ENGINEERING COMPANY, INC.
Walden, New York

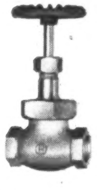
SE 140

Presenting... *the* HAMMOND *heavy-duty bronze valve line*



Now the HAMMOND line includes a broad selection of heavy-duty bronze valves . . . produced to the same high quality standards that have made HAMMOND one of the leading manufacturers of domestic plumbing and heating valves. Each HAMMOND heavy-duty valve is fully tested and meets Federal specifications. Each is backed by HAMMOND's 46 years of experience making bronze valves exclusively. Specify HAMMOND whenever you need a heavy-duty bronze gate, globe, angle or check valve. Write for our condensed catalog No. 146 and comparable valve chart. Hammond Brass Works, Hammond, Indiana.

Some typical HAMMOND high-pressure valves



#413 Composition disc globe with union bonnet and slip-on type disc holder. To 150 lbs. of steam.

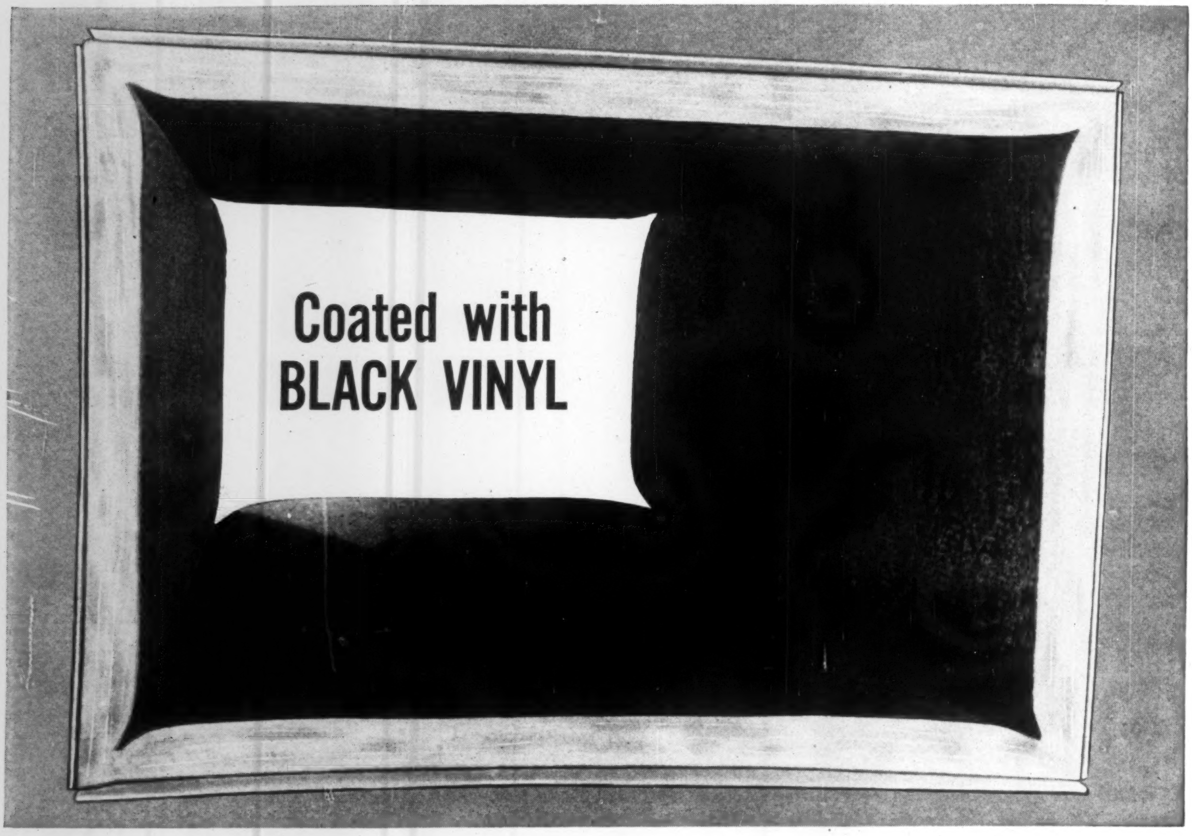
#412 Brass disc regrinding globe with union bonnet. To 300 lbs. of steam.

#610 Quick opening gate valve with cam-operated solid wedge disc. To 125 lbs. of steam.

#619 N.R.S. gate valve with solid wedge disc. To 150 lbs. of steam.

Available at your local distributor now

HAMMOND ***BRITE-KOTE®*** **BRONZE VALVES**



NEW MICROTEX DUCT LINER

saves cost of painting inside ducts; insures complete protection against air erosion; helps speed fabrication

Now you can get duct liner with high acoustical and thermal insulating efficiency . . . *plus* the money-saving advantages of black vinyl coating. Here's why it pays to specify L·O·F Glass Fibers' new Microtex Duct Liner:

1. No painting duct interiors—Black vinyl-coated Microtex saves the cost of painting ducts inside, near grills or large registers. Factory-pigmented coating eliminates chance of paint flaking off into air-stream.

2. Insures full coating—Its black vinyl coating marks the quality of L·O·F Glass Fibers' Microtex Duct Liner. Quality-control inspectors can *see* it's *fully coated* to resist air erosion, even at peak velocities.

3. Saves fabrication time—Pigmented vinyl clearly marks the air-stream side of Microtex Duct Liner. Shows at a glance which side to apply toward adhesive before forming the sheet metal in the brake.

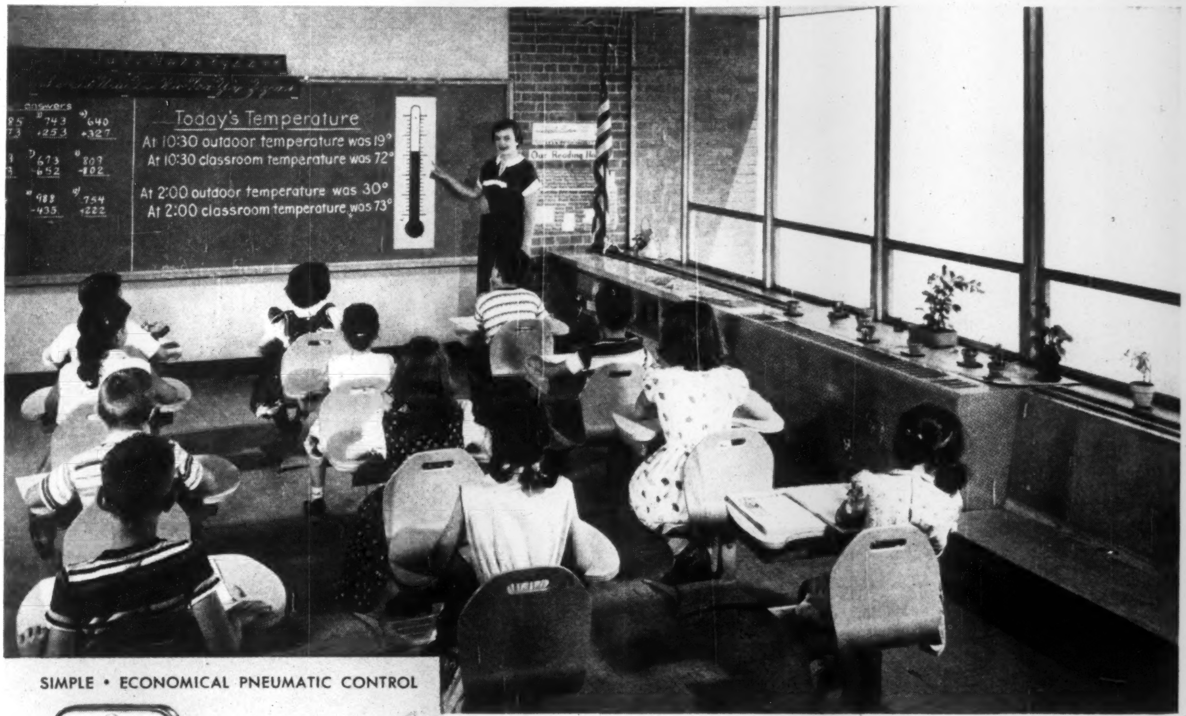
L·O·F Glass Fibers' Microtex Duct Liner offers maximum insulation per dollar. Made from fine glass fibers, it absorbs mechanical noises, particularly in the 250 to 4,000 cps range where most heating and air-conditioning system noises occur. It efficiently insulates warm- and cold-air ducts against heat transfer. When lined with Microtex, the metal of the duct acts as a vapor barrier, minimizing condensation.

Get the facts today on economical Microtex Duct Liner in 1½, 2 and 3 lb./cu. ft. densities. Contact your distributor, or write: *L·O·F Glass Fibers Company, Dept. 39-77, 1810 Madison Ave., Toledo 1, Ohio.*

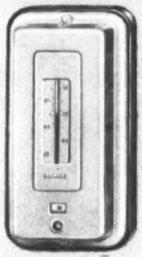
L·O·F GLASS FIBERS

L·O·F GLASS FIBERS COMPANY · TOLEDO 1, OHIO

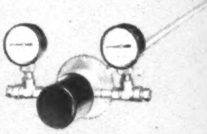
They concentrate best when temperature is right


answers
743 +253
640 +327
673 -652
807 -102
988 -435
754 +222
Today's Temperature
At 10:30 outdoor temperature was 19°
At 10:30 classroom temperature was 72°
At 2:00 outdoor temperature was 30°
At 2:00 classroom temperature was 73°
Our Reading

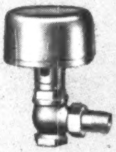
SIMPLE • ECONOMICAL PNEUMATIC CONTROL



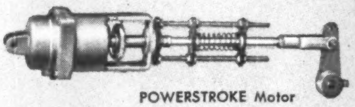
Powers PNEUMATIC thermostats maintain set temperatures constantly. They need no daily checking or re-adjusting.



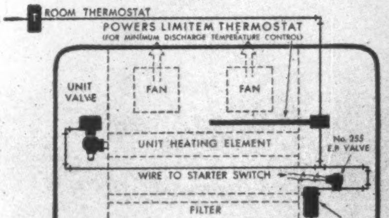
LIMITEM Thermostat has a calibrated dial, adjustable sensitivity and unique supply and exhaust valve which eliminates waste of compressed air.



PACKLESS Control Valve



POWERSTROKE Motor


ROOM THERMOSTAT
POWERS LIMITEM THERMOSTAT
(FOR MINIMUM DISCHARGE TEMPERATURE CONTROL)
UNIT VALVE
FAN
FAN
UNIT HEATING ELEMENT
No. 255 E.P. VALVE
WIRE TO STARTER SWITCH
FILTER
POWERSTROKE MOTOR
DAMPERS

(c30)

POWERS Engineered QUALITY System of Unit Ventilator Control

provides utmost COMFORT at lowest cost for upkeep

Make sure Teachers and Pupils in your new school enjoy healthful comfort assured by Powers control. It meets the most important requirement for classroom comfort–accurate control of unit ventilator discharge temperature.

Powers LIMITEM Airstream Thermostat is the most accurate instrument made for low limit control of unit ventilators. Precise **direct control** holds temperature **constant** at the point desired without alternate drafts of hot or cold air. It needs no auxiliary devices.

Powers PACKLESS Control Valve gives better control due to reduced valve stem friction, eliminates steam or water leakage and banishes packing maintenance. Powers correct sizing of valves helps insure good control.

POWERSTROKE Damper Motor is compact, easy to install and maintain. Hesitation spring provides valve-damper sequence control . . . **If you are planning a** new school ask your architect or engineer to include a Powers engineered QUALITY system of control. You'll insure utmost comfort at lowest upkeep cost.

For further information contact our nearest office

THE POWERS REGULATOR COMPANY

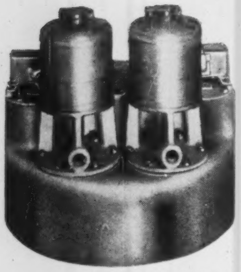
SKOKIE, ILLINOIS | *Offices in chief cities in U.S.A., Canada and Mexico*

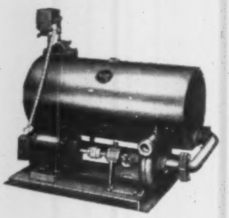
65 years of Automatic Temperature and Humidity Control

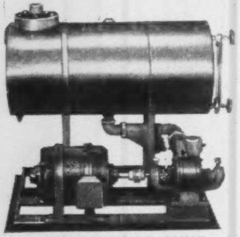
NO NEED FOR CUSTOM JOB

A standard type Skidmore Pump will meet the exacting requirements

4 ways . . . to improved pump performance!


"CVS" VERTICAL PUMP


"HS" CONDENSATE PUMP


"TM" TURBINE PUMP

"UV"
CONDENSATE PUMP

TYPE "CVS"

New, wider range of discharge pressures—from 10 to 40 lbs. Capacities range from 500 to 10,000 sq. ft. E. D. R.

TYPE "HS"

Sturdily constructed for dependable service at small investment — capacities 1,000 to 65,000 sq. ft. E. D.R., discharge pressures from 10 to 75 lbs.

TYPE "TM"

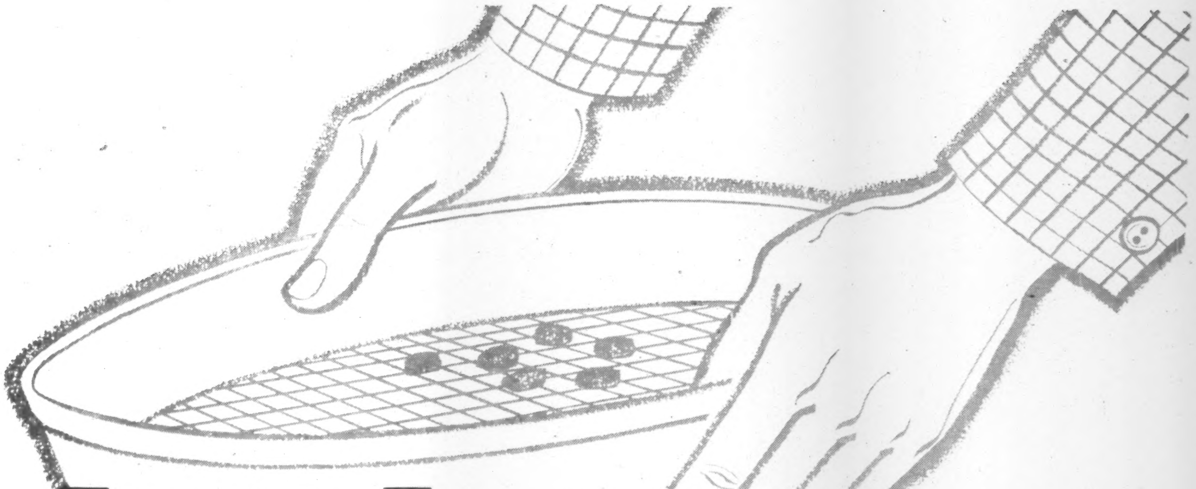
Completely assembled on either steel or cast iron base —capacities, for boilers up to 250 H.P., with discharge pressures to 150 lbs.

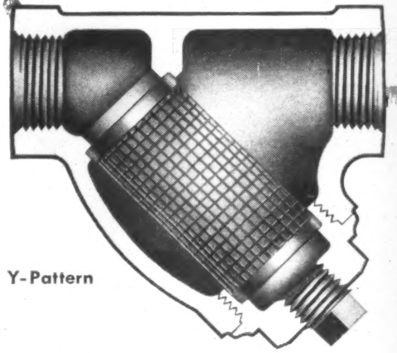
TYPE "UV"

Designed for low return installations — capacities, 2,000 to 40,000 sq. ft. E.D. R. and discharge pressures from 10 to 75 lbs.

**SKIDMORE
CORPORATION**
ST. JOSEPH, MICH.

Choose with Confidence!

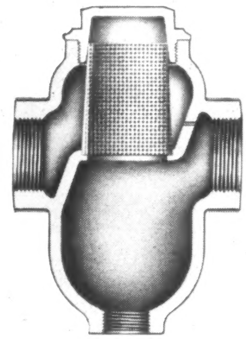




Y-Pattern

Screen out costly maintenance with

CRANE SEDIMENT SEPARATORS



Vertical Types

Crane Sediment Separators positively and automatically trap foreign matter in fluid handling lines—steam, water, air, oil or gas, high or low pressure—and hold it for easy removal.

Dirt, scale, sand and other injurious particles are prevented from damaging or spoiling product and ruining valve seats, automatic devices and other delicate equipment.

Because of their exceptionally large screening areas—more than 500% greater than pipe area—Crane Sediment Separators assure unrestricted flow of product, even when partially plugged. Note special blow-off connection for drain valve attachment which permits easy cleanout without interrupting flow service.

LITERATURE SENT ON REQUEST

Available in both Y-patterns and vertical types, with full range of capacities and sizes. For literature on Crane Sediment Separators, see your Crane Representative or write to address below.

CRANE VALVES & FITTINGS

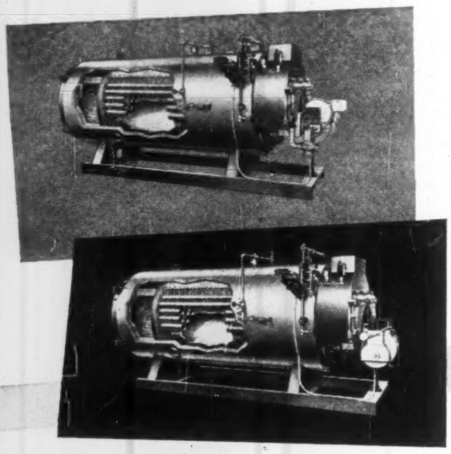
PIPE • KITCHENS • PLUMBING • HEATING

Since 1855—Crane Co., General Offices: Chicago 5, Ill. Branches and Wholesalers Serving All Areas

GOOD THINGS
(LIKE HIGH PRESSURE STEAM)
CAN COME IN

COMPACT PACKAGES

KEWANEE BOILER PRODUCTS



KEWANEE

ALL-WELDED SCOTTIE JUNIOR

Is your next bid to a laundry? A dairy? A cannery, tire recapper, frozen food packer, dry cleaner or other small industrial plant? When processing or power steam requirements figure at 75 hp or less, here is a complete, compact package for the job.

Scottie Junior is a Kewanee boiler and Kewanee burner matched to utilize every available Btu from oil or gas. Six sizes are produced, in both 125 and 150 lb wp. Even the largest Scottie Junior fits under an 8 ft. ceiling, arriving on the job with burner, wiring and all controls in place.

Other Kewanee boilers range to 651 hp and are always ready to prove their world-wide reputation for your customers. Your nearby Kewanee Man has full details, including catalog and specification sheets. Call him anytime. AMERICAN-STANDARD, KEWANEE BOILER DIVISION, 101 Franklin Street, Kewanee, Illinois.

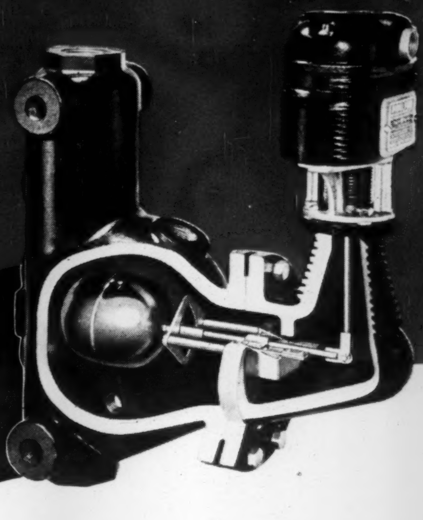
Better Homes
Newsweek

Kewanee Boilers are advertised regularly in national publications.

AMERICAN-Standard

KEWANEE BOILER DIVISION

yes McDONNELL Controls for boilers up to 250 psi!



KNOW THIS 92 SERIES

In Four Models that meet all conditions

Here is the real answer to water level control for boilers up to 250 psi—the McDonnell 92 series providing pump control, low water fuel cut-off, and low water alarm.

This control has exactly what it takes for high pressure and temperature. Notice, for example, the generous float chamber with wide clearances between float and walls.

Keeping heat away from the switch mechanism is a foremost requirement in a control of this kind. In the 92 series an ingenious heat barrier, tapered neck, and fins, combine to effect an unprecedented heat dissipation—well proved by the fact that the 92 series complies with *current* underwriters' specification for 75°C wiring at switch terminals.

The 92 series combines a more effective use of magnetic switch actuation with McDonnell-built open contact switches—switches that do not call for the accurate alignment of the control that is necessary with other types.

There are too many features of the 92 series to cover here, but the whole story can be told in three words: *McDonnell quality throughout!* Note how the 92 series is built for you in four forms to fit right in to any boiler job requirement.

State your conditions. Let us help you select the right 92 series control for your job. Ask for complete engineering folder on 92 series installations, and wiring sheets.

McDONNELL & MILLER, *Inc.*
3500 N. Spaulding Ave., Chicago 18, Ill.

Doing One Thing Well

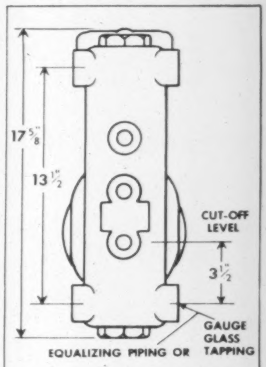
What the 92 series does—The 92 series does three basic jobs, singly or in combination: **(1)** controls boiler feed pump *from* the boiler—exactly as it should be controlled for maximum efficiency **(2)** provides a low water fuel cut-off—cuts current to burner in the event of a low water emergency **(3)** closes circuit for operating low water alarm whenever low water occurs. Series 92 controls are also adaptable to a wide range of industrial liquid level control applications involving pressures up to 250 psi. Upper switch includes extra circuit to gain 3 wire operator for motor operated valves.

The Adaptable Water Column Form

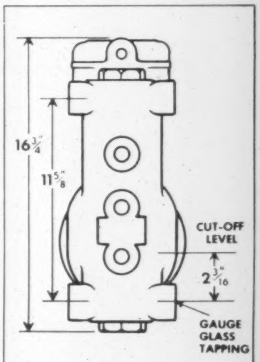
There are two 92 series controls with self-contained, water-column bodies having tappings for water-glass and tri-cocks. Water-column form simplifies installation, provides correct equalization, cuts costs and assures a trim, workmanlike job. Tappings provide for mounting control on either side of the boiler with gauge glass mounted on either side of control. The two 92 series water-column types are:

1 **No. 292** Principle dimensions shown in drawing. Note cut-off level is 3½″ above center of lower gauge glass tapping. This taller body with higher cut-off point assures water level being plainly visible when located high on a big boiler. Control may be installed with either top and bottom or side equalizing connections. Gauge glass tappings may be reduced to either ¾″ or ½″; tri-cock tappings, ½″; equalizing tappings, 1¼″ top and bottom, or 1″ side.

2 **No. 192** Dimensions opposite. Body is shorter, cut-off level lower than in 292, ideal for most fire-tube boilers. Both gauge glass and tri-cock tappings are ½″; equalizing tappings, 1¼″.



No. 292 WATER COLUMN



No. 192 WATER COLUMN

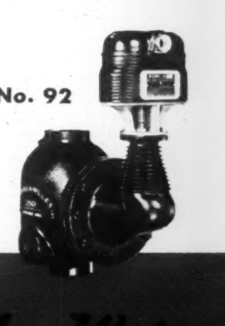
Without Water Column

These two controls have the same basic operating mechanism as 192 and 292, but are designed for installation with independent water column.

3 **No. 92** Has 1¼″ top and bottom equalizing tappings.

4 **No. 92A** Has two additional 1¼″ side tappings for use where equalizing piping takes this form.

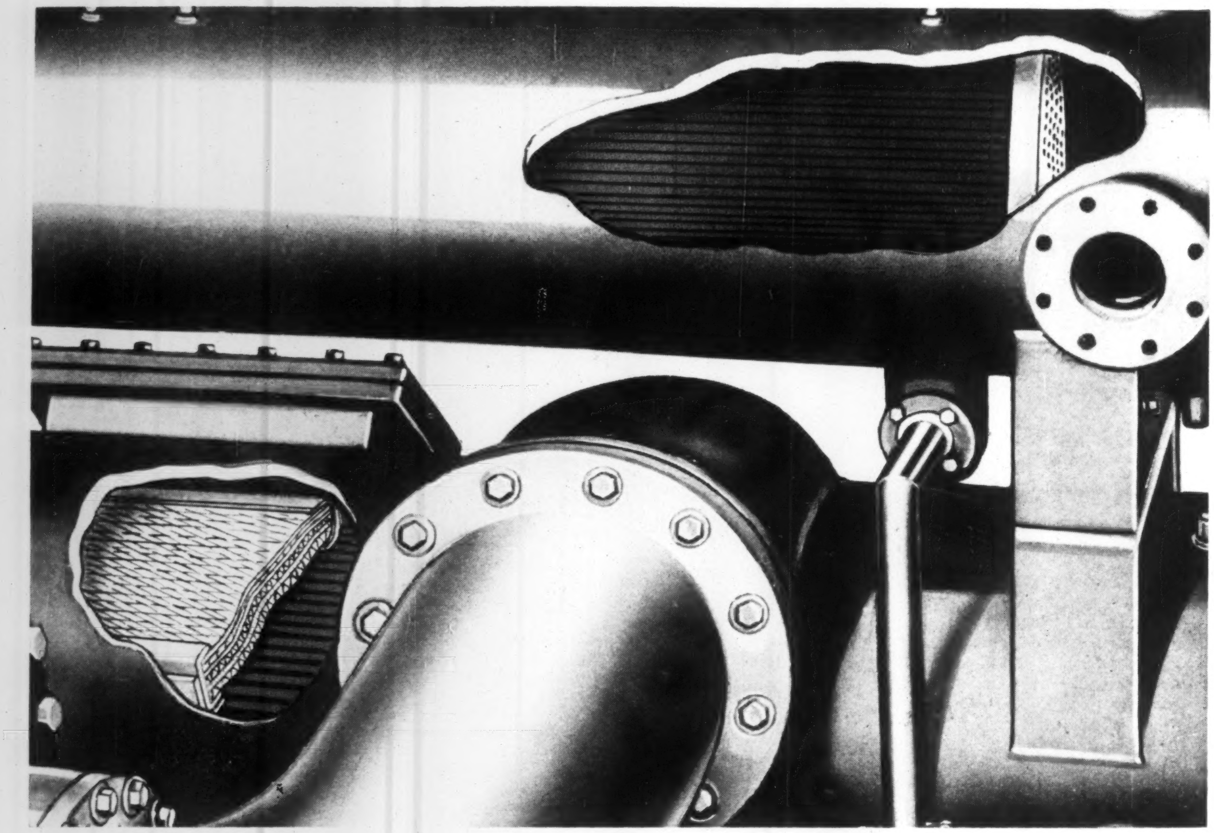
No. 92



No. 92A

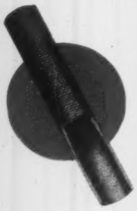
Jobber Stocks Them

McDONNELL *Boiler Water Level Controls*



How The Trane Company Condensed a Condenser

— and a Water Chiller too!



WOLVERINE TRUFIN
Type S/T
Note the integral fins.

In the illustration above you can see exactly where Wolverine Trufin® Type S/T is used in both the condenser and water chiller of a Trane CenTraVac unit. Trufin was used in the design of these applications because it was recognized that Trufin provides more than twice the heat transfer surface of plain tube—extracts more BTU's per foot of tube.

Explaining why his company specifies Trufin for this job, a Trane Company engineer reports: "The principal reason for using Trufin is the advantage of increased surface over what we would be able to obtain from straight tubing. In fact, we would have to use so many more lineal feet of plain tube that in many cases the CenTraVac would become too large in size to be installed in existing buildings where space always seems to be at a premium. You can readily see from this the importance we attach to Trufin."

If your product requires heat transfer, Wolverine Trufin can help you just as it is helping the Trane Company. For complete information concerning sizes, alloys and design, write for the Trufin Catalog.

Wolverine Trufin is available in Canada through the Unifin Tube Company, London, Ontario

CALUMET & HECLA, INC.
CALUMET DIVISION
WOLVERINE TUBE DIVISION
FOREST INDUSTRIES DIVISION
GOODMAN LUMBER COMPANY
CALUMET & HECLA
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1461 CENTRAL AVE., DETROIT 9, MICH.
Manufacturers of Quality-Controlled Tubing and Extruded Aluminum Shapes

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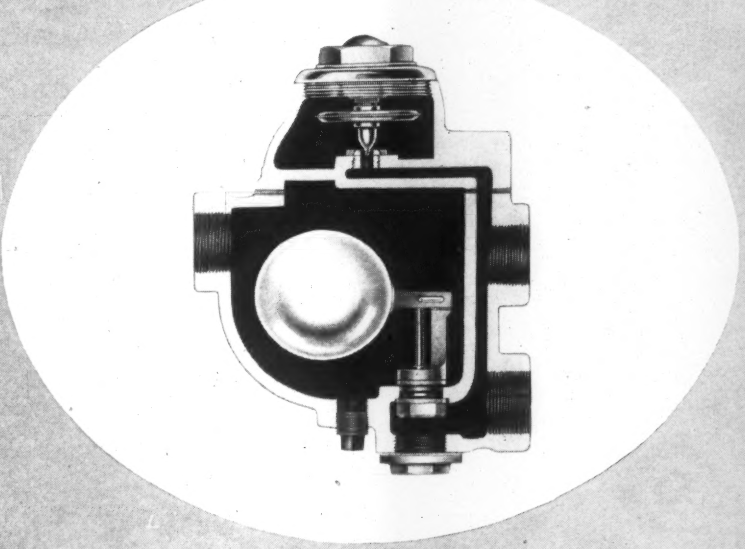
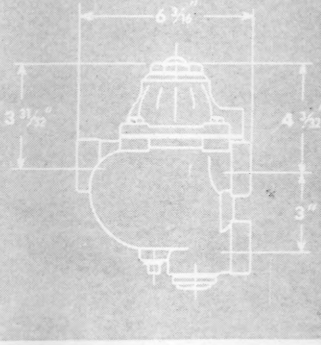
EXPORT DEPARTMENT, 13 EAST 40TH STREET, NEW YORK 16, NEW YORK

MARSH No. 12

Float and Thermostatic Trap



Marsh No. 12, for 0-15 psi, and No. 512, for 15-125 psi, are available in either ¾" or 1" pipe size. Note two optional outlet openings.



. . . The most dependable trap you can use

There are many jobs that only a float *and* thermostatic trap can handle properly . . . and in the Marsh No. 12 you have the most respected F & T trap ever developed.

Here is a trap that counts its users in thousands. Repeat orders are the rule because men who know have discovered that no other trap can quite duplicate its absolutely dependable, trouble-free performance in removing all air and condensate from steam mains, branches, risers, unit heaters, coils, and similar applications.

Two precision-built assemblies accomplish this. All condensation is discharged by the float-operated valve located at the low point in the trap body. All air is vented through the by-pass by the action of the thermostatic diaphragm, but this is one of those Marsh diaphragms that closes the valve immediately in the presence of steam. In fact the accuracy of response is the attribute that distinguishes the Marsh thermostatic element. It gets the air out and keeps the steam *in!* Another big feature is the straight through design which eliminates troublesome excess piping.

No. 12 is your F & T trap for those low pressure applications — up to 15 psi W.S.P. but its identical-in-operation companion, No. 512, covers the working pressure range of 15 to 125 psi. There is a Marsh trap for every low or medium pressure application.

Write for catalog 76-H covering Marsh heating specialties

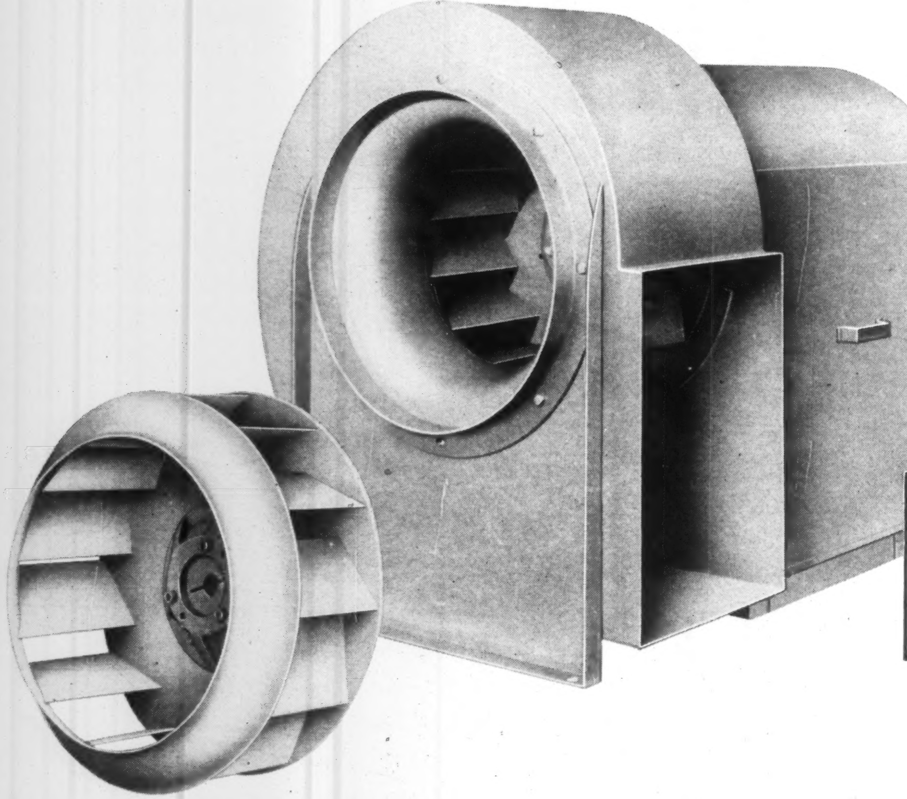
MARSH HEATING EQUIPMENT CO. *Sales affiliate of Jas. P. Marsh Corporation*

Dept. T, Skokie, Ill. Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta

Manufacturers of gauges, thermostatic regulating valves, Solenoid valves, heating specialties

MARSH *Heating Specialties*

SINCE 1865



CERTIFIED RATINGS

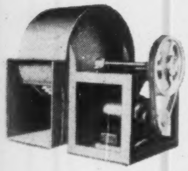
AUTHORIZED BY N A F M

Backward Curve Blowers—Certified Ratings

Completely Designed, Engineered and Manufactured by Peerless Electric

Peerless Backward Curve Blowers are all Peerless—motor and all. We control the entire production of this versatile blower, from drawing board to finished product. We guarantee it unconditionally for quiet, trouble-free operation.

Peerless Backward Curve Blowers can be specified with confidence. They are thoroughly tested according to test codes. They meet NAFM and NEMA standards. Scores of them are operating in schools, churches, hospitals and government installations.



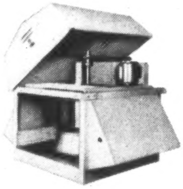
FORWARD CURVE BLOWERS

Made entirely by Peerless; arc-welded housings and frames; wheels designed for quieter operation; dynamically balanced.

See our Catalog in Sweets

CENTRIFUGAL ROOF VENTILATORS

Matching wheel cone accurately fits spun venturi for quieter, smoother air movement. All welded construction; material 16 ga. or over. Each unit air tested, and rated to assure certified PFMA ratings. Fits standard curbs.



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Peerless® Electric

FAN AND BLOWER DIVISION

THE Peerless Electric® COMPANY

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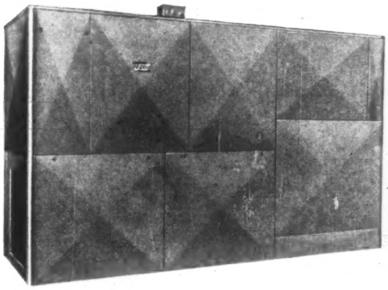
FANS • BLOWERS • ELECTRIC MOTORS • ELECTRONIC EQUIPMENT

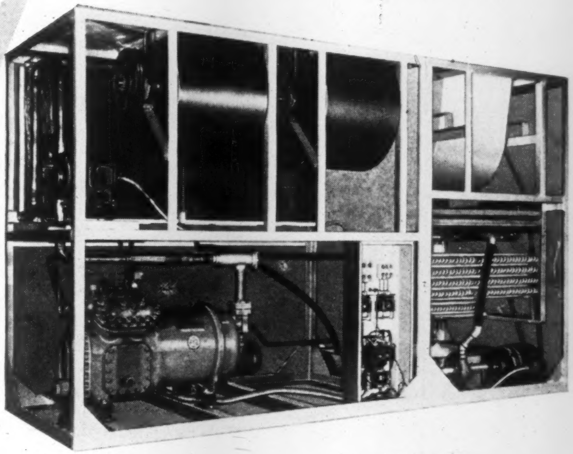
Write Today for Bulletins SDA-220, SDA-200 and SDA-160.

BOHN *Presents*

the NEW ANGLE *in* Industrial Air Conditioners



Here is the completely packaged air conditioning unit for industrial or large commercial installations . . . with easily-accessible conditioner, compressor, condenser, and filter sections . . . completely engineered, assembled and tested in the factory.



easy installation

minimum operating expense

WITH BUILT-IN WATER SAVERS

- Semi-hermetic compressor
- All motors internally mounted
- Insulated conditioner section
- Bearings fed from outside oil cups
- Efficient quiet blowers, dynamically balanced
- 2-stage counter-flo type condenser, all prime surface
- Easily accessible electric control panel built into compressor section
- Heavy gauge bonderized steel cabinet with rigid access panels, easily removed
- Welded and braced structural steel angle frame, coated with rust-resistant primer
- Condenser blower, eliminator, spray tree and water pan—*all hot-dip galvanized after fabrication*

Models range from 5 through 60 H.P. and are available with standard steam, non-freeze steam or hot water heating coils, face and by-pass dampers, capacity control, increment starter and vibration rails.

For complete detailed information write today for free BULLETIN NO. 3000.

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Manufacturers of Commercial Refrigeration. Industrial Air Conditioning and Special Heat Transfer Surface

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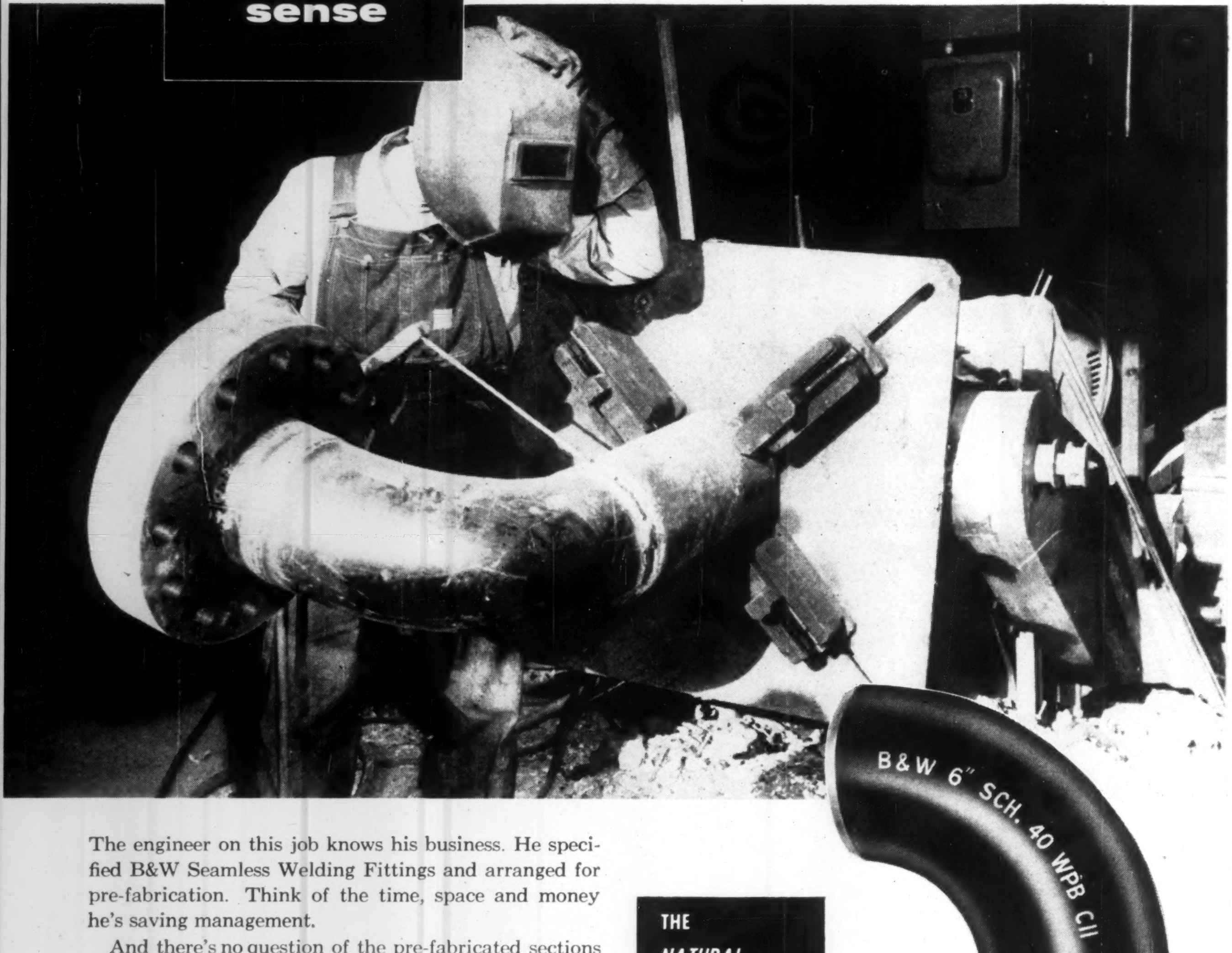
result of an engineer's good common sense

Pre-fabrication saves time, space and money when B&W Seamless Welding Fittings are used!



The engineer on this job knows his business. He specified B&W Seamless Welding Fittings and arranged for pre-fabrication. Think of the time, space and money he's saving management.

And there's no question of the pre-fabricated sections fitting when they're ready to be installed, because they're dimensionally accurate. Full radius, true circularity and smooth walls of exact thickness permit fast alignment and easy fit-up.

This time, specify B&W Seamless Welding Fittings for a permanent, leakproof piping system. Seamless Welding Fittings allow piping to nest closer, are stronger, yet weigh considerably less than other types of fittings. They're available in a complete range of sizes and types in carbon and the B&W Croloys.

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TUBULAR PRODUCTS DIVISION

THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION • FITTINGS DEPARTMENT
3839 WEST BURNHAM STREET • MILWAUKEE 46, WISCONSIN

FA-7905 FE

Seamless welding fittings and forged steel flanges, seamless and welded tubular products — in carbon, alloy and stainless steels.

Current Construction Outlays Rise

. . . 11 percent in May

OUTLAYS for new construction rose seasonally by 11 percent in May to $4 billion, a new high for the month, according to the U.S. Depts. of Commerce and Labor.

May activity brought the total for the first five months of 1957 to a record $17.1 billion, 3 percent above last year's January-May total.

On a seasonally adjusted basis, new construction activity last month was at an annual rate of $46.9 billion, compared with the revised estimate of $46.1 billion spent in 1956.

Important gains so far this year have been made in all major types of private nonfarm construction except new housing and store building. Private spending for construction of utilities, industrial plants, office buildings and warehouses, most community type facilities (churches and hospitals), and for additions and alterations to residential structures set new records in 1957 for the January-May period and showed substantial increases over May 1956. However, the drop in outlays for new dwelling units and stores offset these increases, so that total private outlays for new construction in 1957 just about equaled the 1956 record both for May and for the first five months. ‡

Future Construction Contract Awards Drop

. . . 9 percent in April

CONTRACTS for future construction in the U. S. in April totaled $2,776,431,000, a decline of 9 percent compared to April 1956, according to F. W. Dodge Corp.

The April decline offset a large increase in March. As a result, the cumulative total for the first four months of 1957 — amounting to $10,314,991,000 — showed no change from the 1956 period.

Contracts for nonresidential building, which were a major source of strength during the first three months of this year, amounted to $838,065,000 in April, down 20 percent from the corresponding month a year earlier. Nearly all components of the nonresidential category shared in the decline with the largest decreases taking place in the manufacturing and public building segments. For the first four months of this year, nonresidential contracts totalled $3,664,712,000, about equal to the comparable period of 1956.

Thomas S. Holden, Dodge vice chairman, points out that the year's record thus far seems to indicate a leveling off at the very high rates of 1956. "If this trend continues, total construction activity in 1957 will run very close to the all-time highs set last year," he said. ‡

Air Conditioning Aids Ammunition Storage

. . . experts name conditions

ANOTHER APPLICATION has been found for air conditioning — providing ideal conditions for the storage of ammunition — according to The Trane Co.

Expert gunsmiths point out that ammunition should be stored in a cool, dry place, away from cement walls and floors, with free circulation of air around ammunition cases.

Air conditioning is the quickest and easiest way to meet these requirements, says the company. ‡

Atmospheric Dust Costs $2 Billion Annually

. . . how cities compare

THE DUST LOAD in the atmosphere costs the U. S. public more than $2 billion annually, according to E. A. Tracey, general manager, room air conditioner division, Mitchell Manufacturing Co., "This dust not only increases cleaning and repair bills but, breathed into lungs, endangers our health," he says.

A compilation of new information made by Mitchell Air Conditioning Research Foundation, sponsored by Mitchell Manufacturing Co., shows that scientists, doctors, and civic leaders regard air pollution as one of our most pressing problems.

Extensive investigation by the foundation has resulted in the following list showing the amount of dust particles in the atmosphere of various metropolitan areas:

	Tons of particulate matter per cubic mile
Detroit	153
Charleston	128
Chicago	124
Los Angeles	118
New York	108
Philadelphia	83
Cincinnati	78
Kansas City	65
Portland	64
Atlanta	61
Washington	58
Houston	57
Minneapolis	53
Fort Worth	49
San Francisco	46
Salt Lake City	24

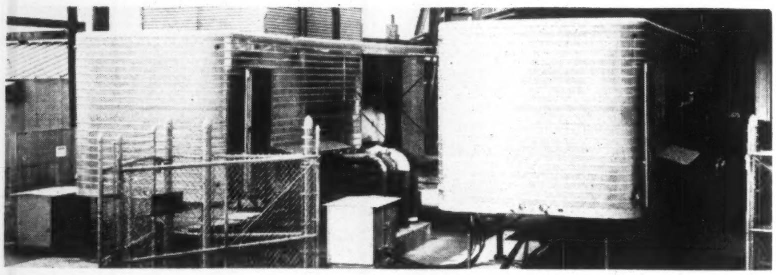
These figures are based on a "fine dust survey" by the Robert Taft Sanitary Engineering Center of the U. S. Public Health Service and cover a cubic mile area up to approximately 100 ft above street level. ‡

Coin New Name for Hot Water Heating-Cooling

. . . hydronics proposed

TAKING note of the great growth of the science of heating and cooling with water, the Institute of Boiler and Radiator Manufacturers has proposed a new name, hydronics, to more clearly identify the multitude of uses of controlled water for heating and cooling.

The new term would also be used to describe the activities of people and operations within the industry, such as an hydronics engineer, hydronics manufacturer, hydronics wholesaler, contractor, or dealer. ǂ



1500 Ton Portable System Conditions Club House

. . . refrigeration plant installed in two big trailers

THE WORLD'S LARGEST portable air conditioning system is providing club house patrons of the Balmoral thoroughbred racing season with comfort this summer at Washington park in Chicago, according to the York Corp.

The unique system, designed by consulting engineer Bud Hattis, of the Robert Hattis Engineering Co., is housed in two giant trailers, each 32 ft long, 10 ft wide and 13 ft high. Installed in each trailer is a high speed turbomatic compressor.

The refrigeration equipment in the two trailers can produce the equivalent of 1500 tons of cooling, enough to handle easily the 200,000 sq ft area to be cooled at the track. Almost 400,000 cfm of conditioned air is introduced into the clubhouse. ǂ

John A. Holbrook Joins HPAC's Editorial Board

. . . expert in hospital work

WE take pleasure in announcing the appointment of John A. Holbrook to HPAC's board of consulting and contributing editors. Mr. Holbrook is administrative engineer for Presbyterian-St. Luke's hospital in Chicago.

He is a graduate of the University of Iowa and has studied in the graduate colleges of Northwestern university and Iowa State college. He is a registered professional engineer in Minnesota and Ohio.

Mr. Holbrook was with Carrier Corp. in Cleveland and has served in several engineering capacities with Belden-Porter Co., heating, piping, and air conditioning contractors in Minneapolis. He is a member of the National Society of Professional Engineers, the American Society of Heating and Air-Conditioning Engineers, and is a member of the committee on engineering and maintenance for the American Hospital Association. ǂ

Don't Wire Conditioner To Room's Light Switch

. . . theory doesn't work

IN A MISGUIDED attempt to cut the use of electricity for window air conditioners, a resort hotel ran the power supply for each of the units through the room light switch. The theory was that as the occupant left the room, he would turn out the lights and thus automatically turn off the air conditioner. At night, the air conditioner could be left running by turning off each lamp individually.

The hotel found out that there are two things wrong with the scheme.

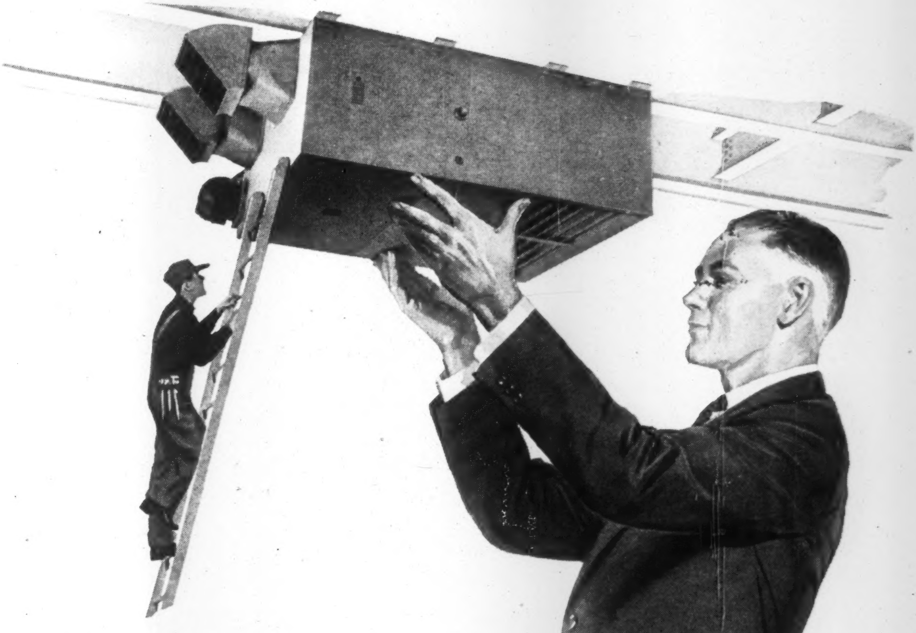
First, many occupants left the lights on when they went out of the rooms, in order that the cooling unit would run. Also, they turned the lights on when they didn't need them, in order to have cooling.

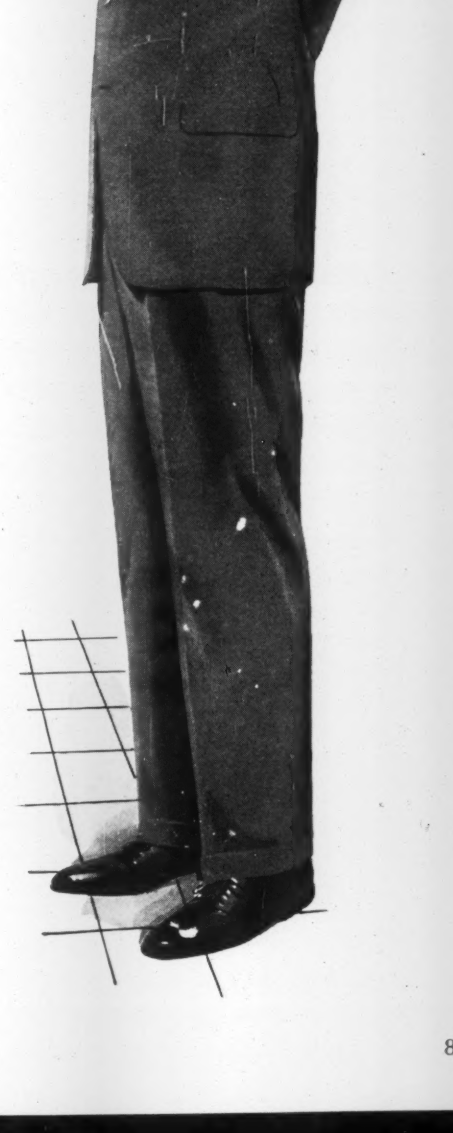
The second objection to the scheme was even more of a problem. On returning to his room, the occupant who had taken the trouble to turn off the lamps individually in order to leave the air conditioner running during his absence would flick the room light switch, stopping the cooling unit but not — of course — turning on the lights. The natural thing to do (we know, because we did it ourselves) is to flick the switch again. This starts the cooling unit before the pressure has had a chance to equalize, and the high head pressure results — more often than not — in blowing a fuse.

As soon as the maintenance man gets fed up with replacing blown fuses, the hotel faces a rather expensive rewiring job. ǂ

"Quote"

"Reading maketh a full man; conference a ready man; and writing an exact man."—*Francis Bacon, Essays: Of Studies.*



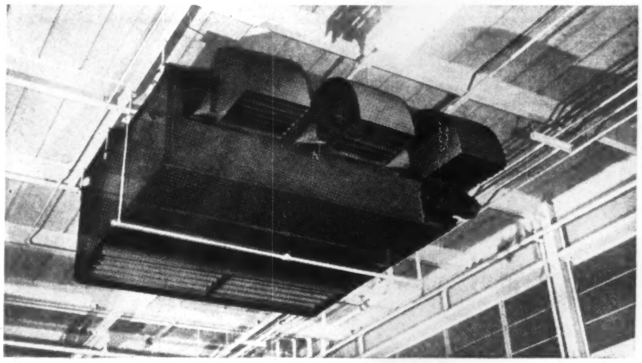


GIANT ANSWER FOR A HARD-TO-HEAT PROBLEM

Your Warren Webster Man holds the answer to comfort heating in problem areas . . . in factories, warehouses, hangars, garages, machine shops. It's the Webster Giant Blower Fan Unit Heater — largest member of the Webster Unit Heater family — and it's backed by Webster's Finest Product, the Warren Webster Man.

Here's uniform, economical, versatile heating and/or ventilating . . . and complete flexibility in size, arrangement and control. Nine sizes, each with one of ten heating elements for steam or hot water, assure exactly the right unit for every need. Up to 28,000 c.f.m. of heated air, at relatively low final temperatures, are discharged at velocities up to 3400 f.p.m. for rapid diffusion, reduced stratification. Mounting may be floor, horizontal-suspended, wall, or inverted. Ask your Warren Webster Man for Bulletin W-135. Or write us.

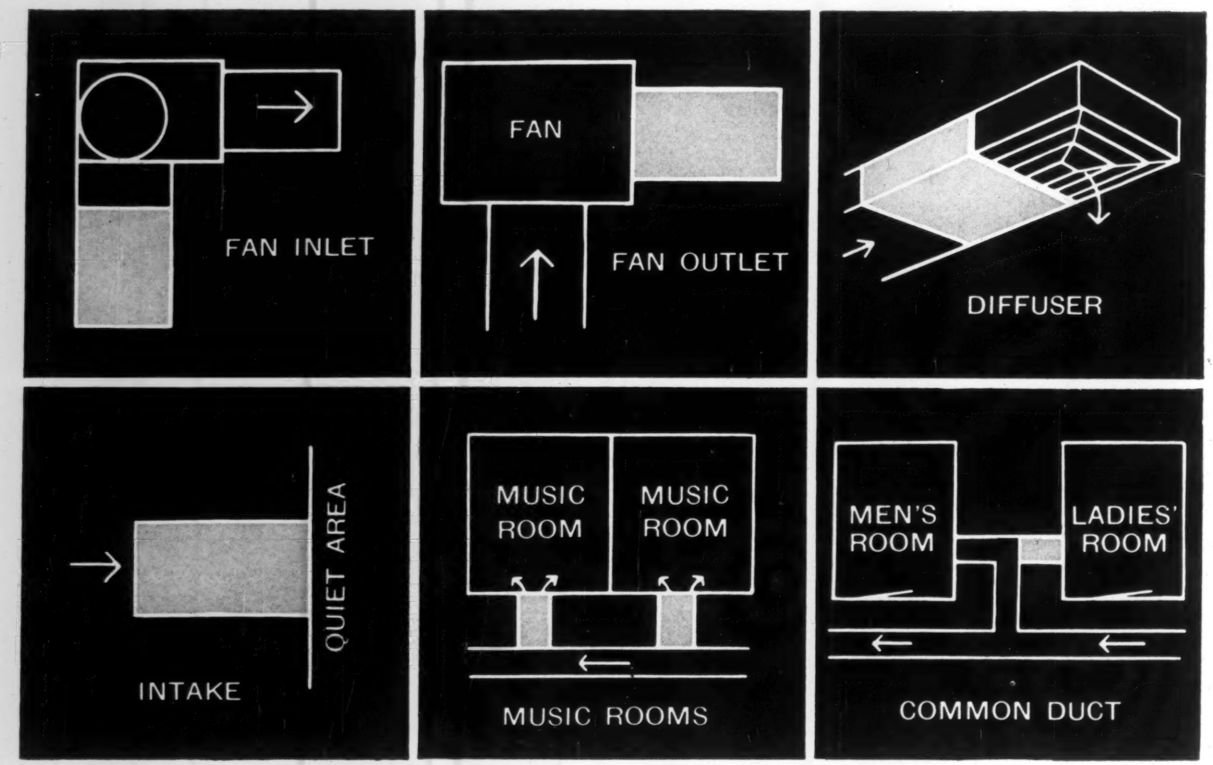
Warren Webster & Company, Camden 5, New Jersey. Since 1888. Offices in 69 Principal U.S. Cities. In Canada, Darling Bros., Ltd.



Webster's Finest Product . . . the Warren Webster Man

WARREN WEBSTER

HEATING . . . COOLING

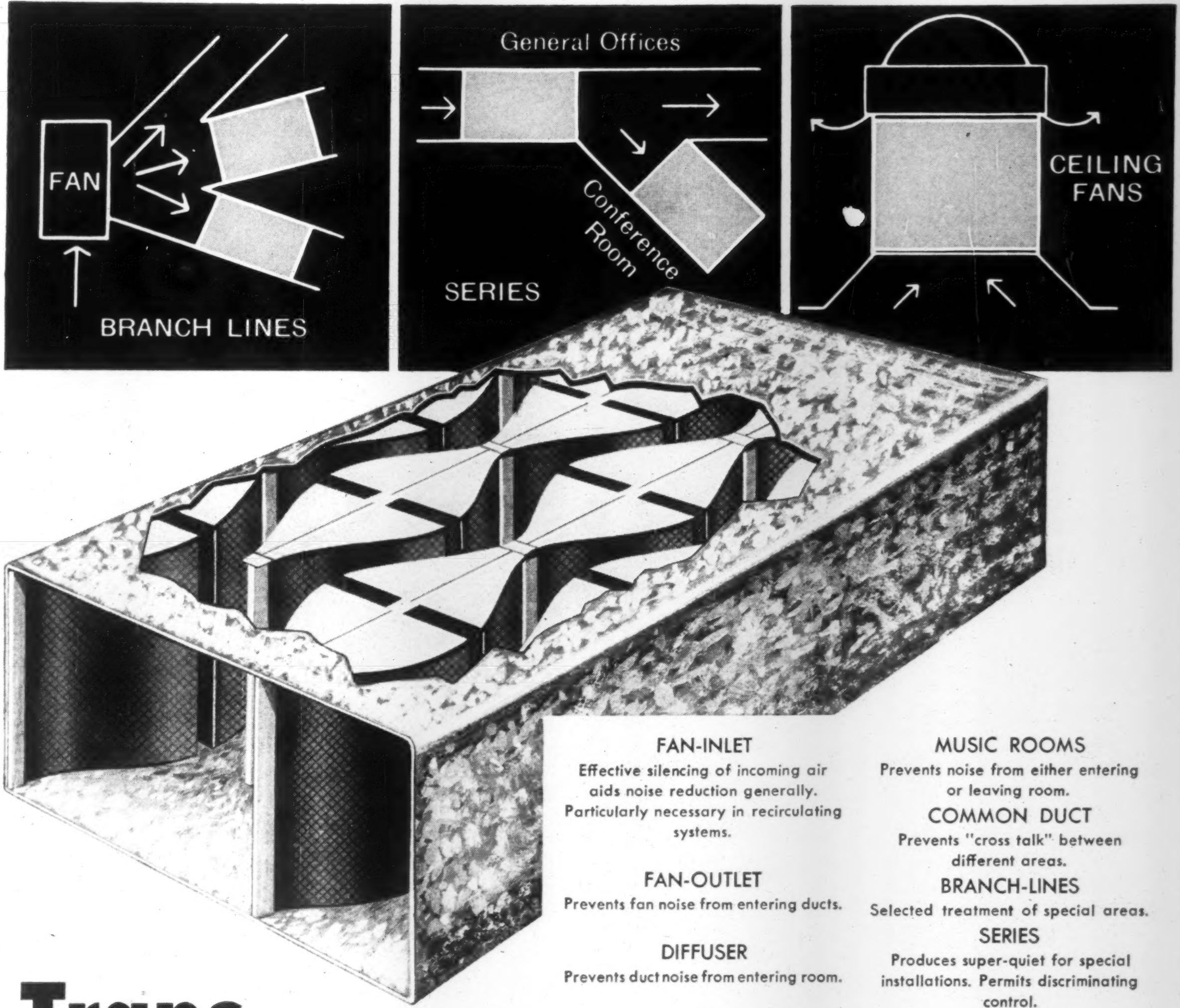

FAN INLET
FAN
FAN OUTLET
DIFFUSER
QUIET AREA
INTAKE
MUSIC ROOM
MUSIC ROOM
MUSIC ROOMS
MEN'S ROOM
LADIES' ROOM
COMMON DUCT

Every Building Needs *Aircoustat*® Sound

AIRCOUSTAT silences noises of all frequencies

Eliminate disturbance, distraction and irritation caused by noises escaping from one area to another through ductwork.

Install AIRCOUSTAT Sound Traps. AIRCOUSTAT eliminates guesswork, wasted space and unnecessary expense of duct lining. You can guarantee your client trouble-free performance. You can estimate with complete confidence the performance of particular applications. If AIRCOUSTAT fits geometrically, it fits acoustically.



FAN-INLET
Effective silencing of incoming air aids noise reduction generally. Particularly necessary in recirculating systems.

FAN-OUTLET
Prevents fan noise from entering ducts.

DIFFUSER
Prevents duct noise from entering room.

INTAKE
Prevents outside noise from entering quiet area.

MUSIC ROOMS
Prevents noise from either entering or leaving room.

COMMON DUCT
Prevents "cross talk" between different areas.

BRANCH-LINES
Selected treatment of special areas.

SERIES
Produces super-quiet for special installations. Permits discriminating control.

CEILING FANS
Prevents fan and exhaust noise from disturbing particular areas.

Traps

traveling from one area to another through ductwork

AIRCOUSTAT saves you space. Its greater effectiveness permits smaller-sized ducting. It eliminates bulky mufflers.

For more details, write to KOPPERS COMPANY, INC. Industrial Sound Control Dept., 6207 Scott Street, Baltimore 3, Md.

KOPPERS

INDUSTRIAL SOUND CONTROL

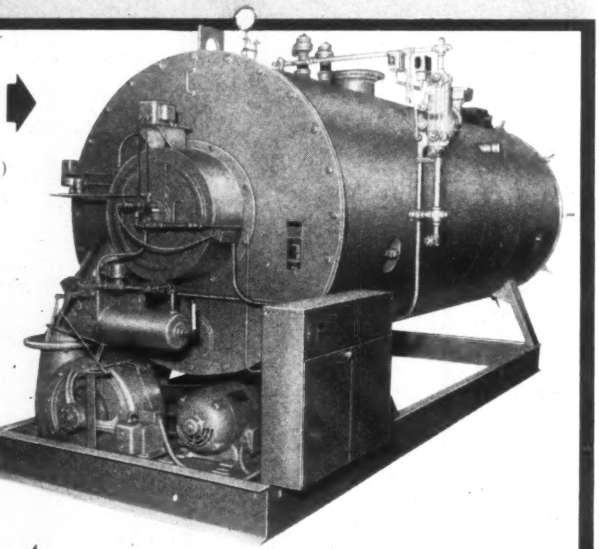
Engineered Products Sold with *Service*

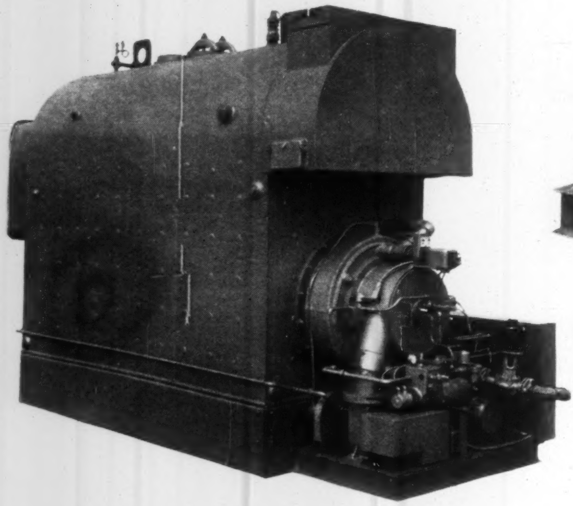
For any type or size of Automatic Boiler . . .

specify YORK-POWER

No longer are automatic boilers limited to one type of boiler. York-Power now offers a complete selection--2-pass Scotch Marines, 3-pass Scotch Marines, and 4-pass Fire Tubes—in a complete range of sizes. All York-Power boilers are automatically fired with oil or gas and can be furnished for combination gas-oil firing. All York-Power automatic boilers are complete on one skid and are fully wired. All York-Power automatic boilers are fire-tested for operational efficiency.

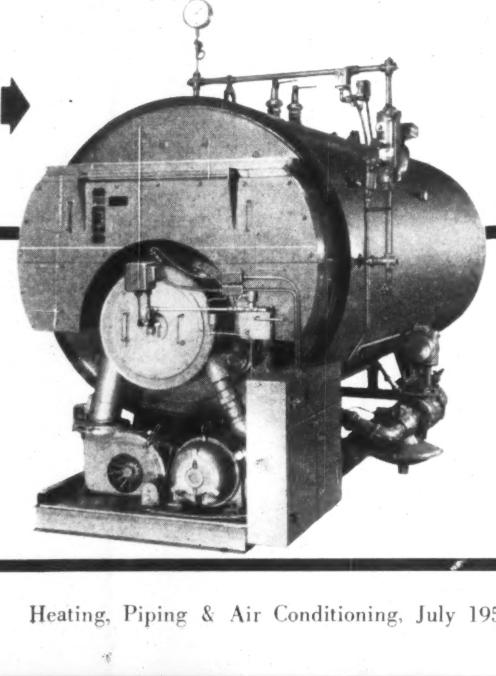
Steam-Pak Automatic Boilers
featuring 3-pass Scotch Marine design ◆ High or Low Pressure Steam or Hot Water ◆ 15 to 600 Horsepower
(Also available in Steam-Pakette design from 10 to 50 h.p.)

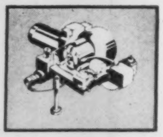




Fire-Pak Automatic Boilers
featuring 4-pass Fire-Tube design ◆ Low Pressure Steam or Hot Water ◆ 35 to 485 Horsepower
(Steam-Pak firing system with forced draft burner)

Scot-Pak Automatic Boilers
featuring 2-pass Scotch Marine design
with either forced, induced or natural draft.
45 to 400 horsepower





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York-Power line of automatic boilers

Industrial Division
YORK-SHIPLEY, Inc.
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Pioneer Specialists of Automatic Heat and Power
Also manufacturers of York-Power Burners

"Open for Discussion"

• *WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Article Is Logical Guide to Field Balancing High Velocity Systems

THE ARTICLE *How to Balance High Velocity Air Conditioning Systems*, by William J. Waeldner in the March and May HPAC's, will provide a logical guide for contractors in field balancing high velocity systems. Part of the article reporting the presentations at the High Velocity Distribution Symposium in 1957 entitled *Field Testing*, published in the ASHAE Journal Section of the April 1956 HPAC, also sets forth a comparable procedure.

However, there are several items in Mr. Waeldner's article which appear to be over-generalized.

The author states that "the valves of all high velocity units should be adjusted to a fixed position at a media of the capacity static pressure range . . . before they are shipped from the manufacturer's plant. Thus, when installed on a job the capacity handled by all units will approximate the final balance." In essence, this is a prebalance before installation. It would seem that this procedure eliminates the need for any further discussion of balancing other than a fan volume check.

Practically, this does not allow for the exigencies of field construction which are bound to occur on nearly all systems. The contract plans can seldom predict all variations in the field construction and structural interferences in main duct locations, fitting arrangements, and unit branch connections, all of which can vary the duct distribution pressure. All units of like size at constant static pressure may vary widely in cfm capacity to produce plan volume. Fitting one box to a specific location is impractical on large systems where 1000 to 1500 units are installed.

Fan damper adjustment prior to unit checking will in many cases provide inadequate pressure at the farthest units. The design static pressure on the fan will have to be balanced against the actual system loss. If all unit dampers are opened first and the air volume from units close to the fan, and at the midpoint are checked, the engineer then has a clear picture of the volume distribution from the main duct. The fan may then be checked for volume and may be speeded up if all of the units were receiving too little air. Or the fan may be slowed down if all of the units were getting too much.

Possibly, all of the pressure adjustment would have to be accomplished at the high velocity unit which would then affect the pressure-volume relationship of the fan. The fan speed may be changed with a variable speed drive or a variable diameter pulley to change fan volume on a single-duct constant-volume system. Fan outlet dampering at higher than necessary operating speeds consumes excess horsepower. In a double duct system a fan inlet control will vary the inlet pressure drop to maintain constant volume as the discharge static pressure varies in the heated and cooled duct.

Branch line dampers installed on single duct systems or static pressure regulating dampers installed in the branch ducts of double duct systems reduce the time required in final balancing. Static pressure regulating dampers installed in the branch of double duct systems are in no way different from branch dampers in single duct systems. High velocity duct dampers are more critical than low velocity duct dampers and must be installed in accordance with the manufacturer's recommendations to eliminate difficulties of operation. Such dampers are directly comparable to low pressure duct branch dampers where a single point damper adjustment for an entire branch duct volume may be made without the necessity of rebalancing individual units.

A double duct system where the cold air duct is supplying 100 percent of the fan volume with all of the controls open is in essence a single duct system arrangement. The author states that the last outlet on the longest equivalent length of run should be operating with an open unit damper. When the branch duct has been balanced the duct static pressure at the control point can then be measured and the static pressure regulator damper adjusted to open fully. Their function is to control the static pressure at this point. During temperature modulation when air is being supplied in both ducts, the static pressure will rise and the damper will then control in a modulated position.

Field checking the control of any mechanical unit through existing access openings such as the neck of the diffuser is desirable, as this can minimize extra access doors in plaster ceilings. At best, only limited access is possible with a unit installed in the ceiling, and with the field man working on a ladder, arms outstretched over his head and with poor visibility.

W. L. BATCHELOR
Assistant Chief Engineer
Tuttle & Bailey
Div. of Allied Thermal Corp.
New Britain, Conn.

Finds Shell Coefficient Deficient; Doubts Rating Would Influence Design

THE "SHELL COEFFICIENT" proposed by Willie Hammer in the article, *Thermal Ratings of Buildings Can Be Uniformly Compared*, in the September HPAC, as a basis for comparison of thermal characteristics of buildings. is similar to the "Exposed Area" basis recommended to the National District Heating Association some time ago.

Both have the same deficiencies. Namely, they do not include consideration of some of the major factors that affect heat requirements of buildings, such as ventilation, internal heat gains, and heat from the sun. The effect of these factors was well explained by L. R. Fuller in an article entitled *Why Are So Many Classrooms Overheated?*, in the January HPAC.

Another basis of comparison suggested to the NDHA was a "Composite Coefficient" *identical* to the "Shell Coefficient." This includes adjustments for every factor affecting heat requirements to be used when applicable. This method is as accurate as the available data and as simple as the characteristics of the building to which it is applied.

Ignoring for the moment the deficiencies of the "Shell Coefficient" method, there is no assurance that the introduction of a rating schedule would influence the design of buildings appreciably, because of other design factors involved. Many buildings surfaced almost entirely of glass are not considered shoddily built, and the extra net heat requirement is considered repaid by other economic factors (greenhouses not included).

Well insulated, practically windowless office buildings would have a very favorable "Shell Coefficient" rating. A few such buildings were constructed and widely publicized years ago but had little effect on design of subsequent buildings. Manufacturers of the most economical automobiles do not obtain large sales volumes, in spite of numerous consumer surveys indicating widespread interest in such cars.

Probably the first step in obtaining a standard of comparison should be to specify all of the conditions necessary for accurate application of the 65 F deg day base. This base is reasonably accurate for comparing gross heat from all sources. In many cases, however, it should not be used in comparing net heat from space heating systems without appropriate adjustments for heat from sources other than the heating system.

R. A. PARSONS
Board of Water and Electric Light Commissioners
Lansing, Mich.

THE AUTHOR'S REPLY—It seems to me that most of Mr. Parsons' objections regarding the use of the "Shell Coefficient" pertain to exceptional cases.

An all glass building may be beautiful and well built, but it will still be of poor thermal construction; conversely for the well insulated, windowless building. The proposed standard is to measure thermal rather than aesthetic design.

Because large numbers of people buy less economical cars does not reduce or change the quality of the better ones. As they begin to compare mileage per gallon, the owners of the less economical cars may have regrets. The proposed thermal standard will permit prospective building owners to make similar evaluations before they begin to have regrets because of high operational costs.

Ventilation is considered in the "Shell Coefficient." For heating, other heat gains which cannot be depended upon, such as heat from the sun, should not enter into the design. If a school is overheated, it is usually the operating engineer's fault rather than that of the design engineer. For cooling, the "Shell Coefficient, Heating" could be used for comparison of quality of construction; and "Shell Coefficient, Cooling" could be used for determination of operating costs. The difference between the two is the internal and solar gains Mr. Parsons mentions.

To initiate a firm method of rating buildings thermally would necessitate that conditions of comparison be delineated. Minor details should be eliminated. After the basic method is set into use, comparison between the theoretical results and actual results would permit evaluation of other factors.

HPAC's readers could be of great help in determining what conditions should be specified. I am of the opinion that the simpler the standard, the more it will be utilized by technical and nontechnical persons.

WILLIE HAMMER
Chief, Heating Unit
Repairs & Utilities Div.
Office of the Engineer
HQ. Army Forces, Far East

Charts for Designing Low Pressure, High Pressure Gas Piping Corrected

REGARDING the February and March HPAC Data Sheets giving the flow charts for designing low pressure and high pressure gas piping, two corrections are suggested by R. V. Warrick, assistant utilization engineer, American Gas Association, New York.

He points out that in the high pressure chart, the ordinate should be $P_1^2 - P_2^2$ per 100 ft, or "squared pressure differential."

On the low pressure chart, the text showing the term K is not explained. This is a variable friction factor, according to the equation:

$$K = \sqrt{D^5/[1 + (3.6/D) + 0.03D]}$$

where D = liameter, in.

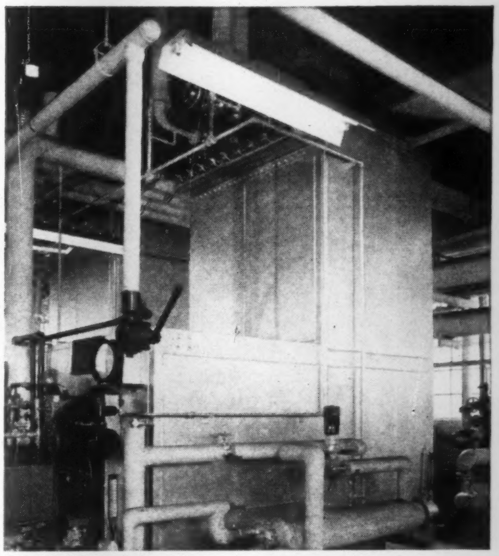
Our thanks to Mr. Warrick for these suggestions.

The Cross Company specifies . . .

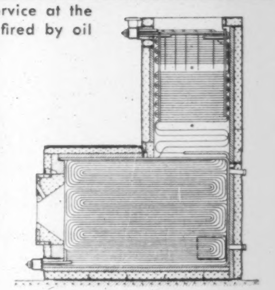
High temperature water by C-E for heating economy ...low maintenance

The Cross Company, pioneer producer of automation machinery, has recently completed an ultra-modern plant in Fraser, Michigan – practically doubling its former production capacity. After a thorough study of heating requirements . . . and with a view toward further expansion . . . two C-E LaMont Controlled Circulation Hot Water Boilers were specified for the new plant. According to Mr. W. P. Reece, Plant Engineer, "the study indicated that this system would provide the lowest fuel and maintenance costs . . . Experience during this winter confirms the soundness of our decision."

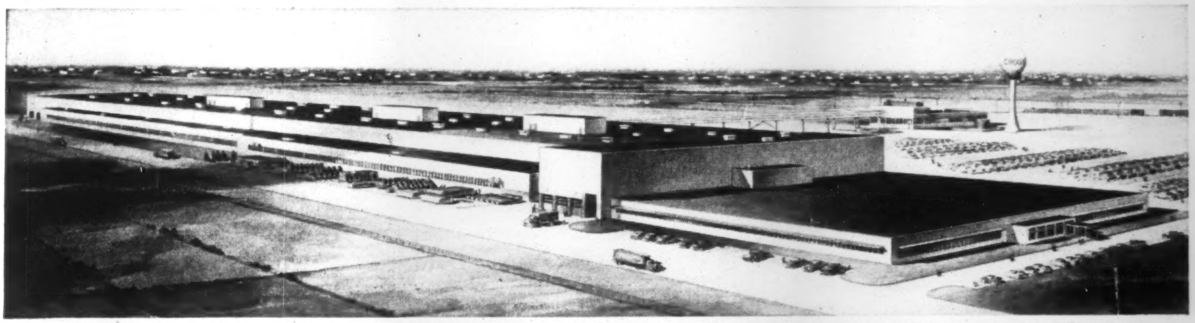
If you are in the market for a heating or process system, it will pay you, too, to investigate high temperature water. Individual needs vary, of course, and both hot water and steam boilers have their place. Our engineers will be pleased to discuss the subject with you or your consultants. Write for our catalog HCC-2.



C E HT Water Boilers in service at the Cross Company. They are fired by oil or natural gas.



Right – One of the 12 million Btu/hr Cross Company boilers. C-E HT Water Boilers are available in sizes from 10- to 300 million Btu per hour; pressures to 500 psi and temperatures to 470F.



Architect's drawing of the new Cross Company plant, Giffels and Vallet, Detroit, Consulting Engineers; Owen S. Lieberg, Associated Consultant.

THESE ARE THE GENERAL ADVANTAGES OF HIGH TEMPERATURE WATER:

1. Higher available heat – many times that of steam at the same pressure.
2. Closer control of temperature.
3. Lower heat loss . . . unused heat returns to the boiler . . . no condensate return lines.
4. No elaborate feedwater treatment . . . make-up requirements are exceptionally low.
5. Steam traps not required . . . trap problems and expense are eliminated.
6. No blowdown losses . . . no safety valve vent losses . . . no condensate losses.

THESE ARE THE SPECIFIC ADVANTAGES OF THE C-E "HT" WATER BOILER:

1. Complete control over circulation in both system and boiler.
2. No separate boiler pump is required, since low pressure loss is inherent.
3. Pressurized operation with oil or gas means no induced draft fan.
4. Single-pass design – no baffles – means cleaner boiler and lower draft loss.
5. Controlled, positive circulation permits more efficient arrangement of heating surfaces.
6. Any fuel – oil, gas, coal, or any combination of fuels.
7. Gastight, welded, steel casing.
8. Fewer headers, all of which are easily accessible.

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Question of the Month

How Should We Heat a Thawing Shed?

This question was asked previously in HPAC and is repeated here along with an answer that has been received from a reader. Other answers or comments for publication are invited.

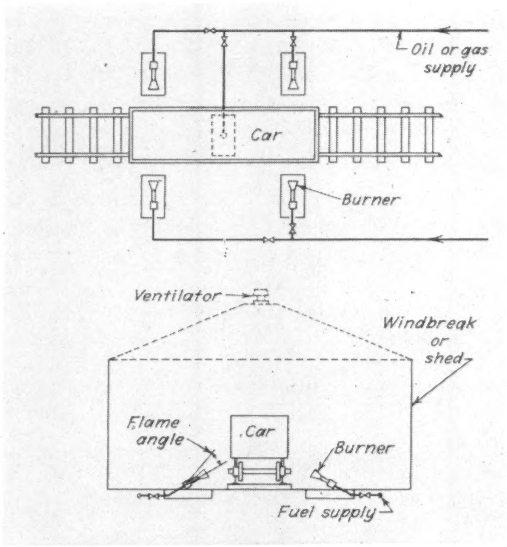
> *"We have been asked to design the heating system for a coal and ore thawing shed where the temperature is to be maintained at 200 F. It seems that direct fired heaters would satisfy this requirement, and this has been suggested. If direct fired heaters are to be used, the air within the shed is to be recirculated through the heater continuously. Ducts will be used to distribute this heated air to the locations in the shed where it will do the most good in the thawing operation. The ice crust around the perimeter of the coal and ore cars is about 15 in. thick under design conditions."*
> *—R.C.B.*

Suggests Using Oil or Gas Fired Burners, Hot Water Spray

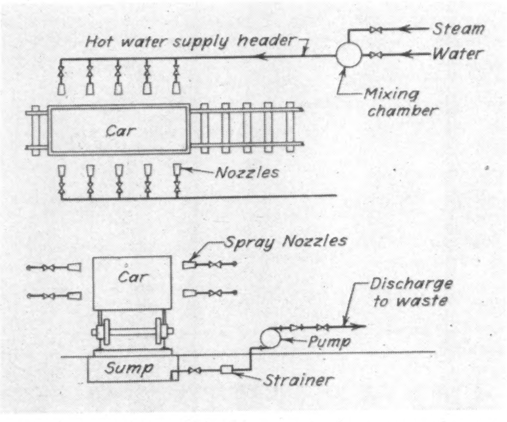
SEVERAL methods are available for heating cars for thawing coal and ore. One arrangement has the car, or cars, spotted over pits, using oil or gas fired burners, as shown in Fig. 1. Low investment and operating costs are advantages of this arrangement. Maintenance requirements are minimum. Also, the heat source — combustion gases from the burners — may be regulated to suit varying conditions. With this design, precautions are necessary to avoid high concentration of heat in small areas, which will lead to possible warping of the car sides and bottoms.

A windbreak may be used where high velocity winds prevail. This will help to keep the hot gases directed against the cars and also reduce convection heat loss. If an enclosed shed is used, a means of ventilation such as roof monitors should be installed to remove the products of combustion.

Another method of thawing ore and coal is to spray hot water on the car sides, as shown in Fig. 2. With this arrangement, steam is combined with water in a mixing chamber and the hot fluid is directed through nozzles against the car. Provision for draining the water from the area is necessary. Seldom is the condensed steam and water recovered for re-use because of possible contamina-

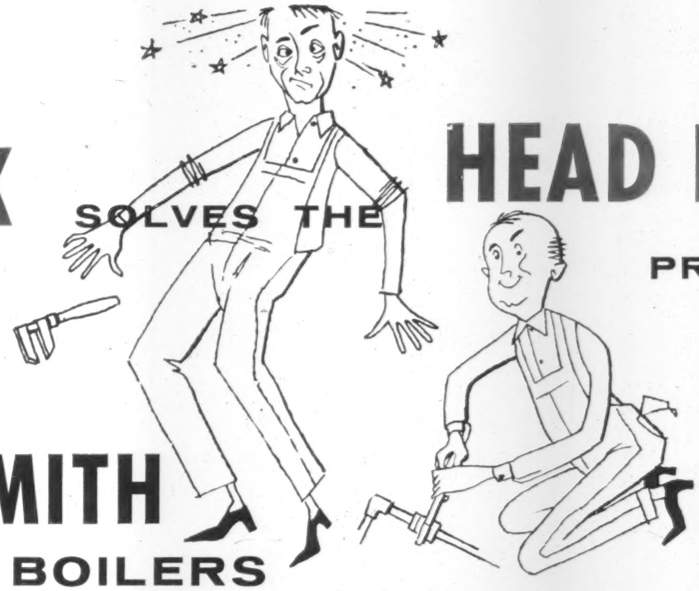


1 OIL OR GAS FIRED BURNERS at 45 deg angles from below thaw cars over pit by heat from combustion gases. Windbreak or shed is recommended

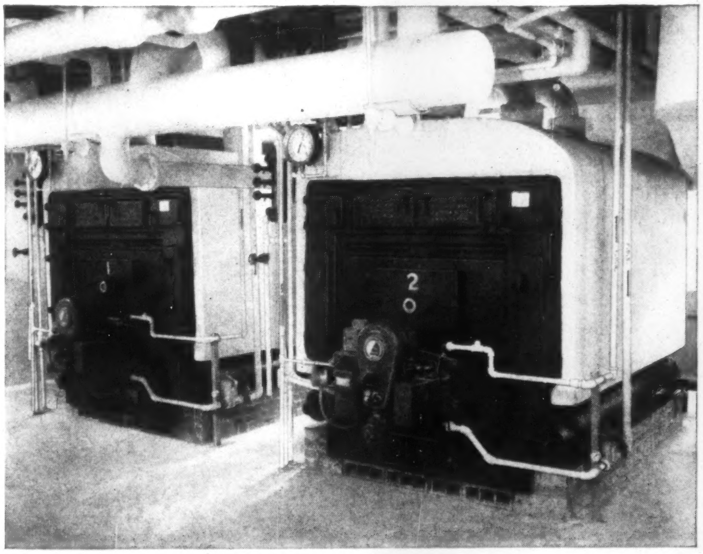


2 HOT WATER SPRAY — mixed steam and water — may be directed against car sides in the manner shown here

HEAD WORK SOLVES THE HEAD ROOM PROBLEM



WITH H. B. SMITH LO-SET BOILERS



It was planned to use heavy oil in two new buildings housing the service areas and restaurants at the Bordentown Interchange of the New Jersey Turnpike. The buildings were designed to utilize a minimum of boiler room height. The problem was solved by the installation of two No. 42 LS-16 Smith Lo-Set boilers for heavy oil in each building. They are fired with horizontal rotary oil burners with induced draft — year 'round operation for heating, air conditioning and domestic hot water requirements.

H. B. Smith 42 Series boilers have a long and consistent record of high efficiency when fired by heavy oil. Their advanced flue design and large area of heating surface assure fast and thorough heat absorption which results in important fuel economy.

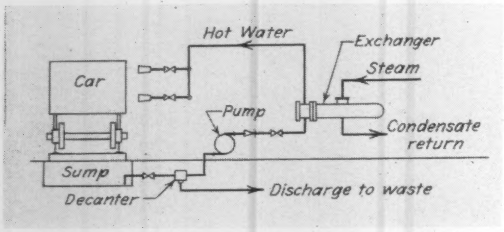
Ordinarily, these boilers are erected on concrete or brick foundations built to a height which would best accommodate most industrial oil burners. However, applications are sometimes encountered where there is insufficient head room above the boiler height to permit addition of the masonry base of the boiler. To meet — and beat — this problem, H. B. Smith supplies 42 Series boilers with a special front section and oil burner mounting plate. Since oil burners from various suppliers require different openings in the face of the plate, fronts are furnished with plain surfaces which may be drilled and cut to the proper specifications for the burner.

H. B. Smith Lo-Set 42 boilers have been extensively tested under exacting and widely varying conditions. Results establish that the boilers operate with customary H. B. Smith dependability at high operating efficiency.

H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • *Established 1853* tion. The first cost for this design is less than that for pit burners, but operating expense may be greater due to water losses. This is more pronounced if the latter is chemically treated.

An alternate design employs a closed heater having the condensed steam returned to the boiler without being contaminated. Also, the heated water may be drained to a sump and recirculated through the nozzles by a pump. To avoid possible clogging of the pump, piping, and nozzles, a decanter may be installed as shown in Fig. 3 to separate the solids from the water.



3 DECANTER, between sump and pump, separates solids from recirculated water, protecting pump, piping, and discharge nozzles against clogging

I would not suggest using the method proposed by R.C.B. because air as the heating medium will require large heat transfer surface areas with large volumes of air being required to provide the needed heat. The main reason for these is that the specific heat of air is low.

From estimates of first cost and operating expense for the heating methods described above, R.C.B. could determine fixed charges and direct costs, which will allow selecting the most economical design that will require minimum annual cost.

H. B. WAYNE
Consulting Engineer
Woodhaven, N. Y.

Reader Asks—

"What Vapor Transmission Rules Apply When Planning for Dehumidification?"

"If we consider a sealed room, in which the air is at a low dew point temperature, and we suddenly open a relatively small door to the outside where there is a high dew point temperature,

"a) At what initial rate will water vapor leave the room per sq ft of opening?

"b) Does this rate vary with time elapsed after the door is opened? If so, what is the relationship?

"c) How can the time required for the entire room to reach outside vapor pressure be calculated in terms of room volume and dimensions? It is assumed that there is no air movement through the doorway and that inside and outside air are at the same temperature such as 85 F with an initial vapor pressure difference of 0.4 in. Hg.

"d) If it is now assumed that air flows outward through the doorway, at what velocity must it flow to prevent inflow of water vapor?

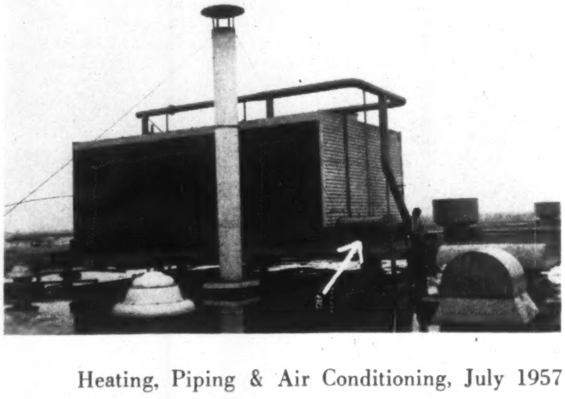
"Answers and comments from other HPAC readers on this will be greatly appreciated."—H.P.W.

• *YOU ARE INVITED to answer this question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

Dissolved Gases Made Cooling Tower Water Corrosive

. . . corrected by higher stack and chemical treatment of condenser water

DOWNWIND FROM A SMOKESTACK, a cooling tower developed a strong corrosive condition which disrupted the 660 ton air conditioning system at the new Schick, Inc., plant at Lancaster, Pa., according to Water Service Laboratories, Inc. Analysis disclosed the source of the trouble, and the problem was solved by increasing the stack height 15 ft and by installing a chemical feeding device that treats condenser cooling water at the tower. ±



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THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS

It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- ✓ Increased air capacity induces rapid system response without wasteful overheating.
- ✓ Separate air and water pumps individually selected to meet actual job requirements.
- ✓ Control system that operates individual pumps only when needed.
- ✓ Flexibility permitting addition of radiation without changing basic pump installation.
- ✓ Low, low, return line connection.

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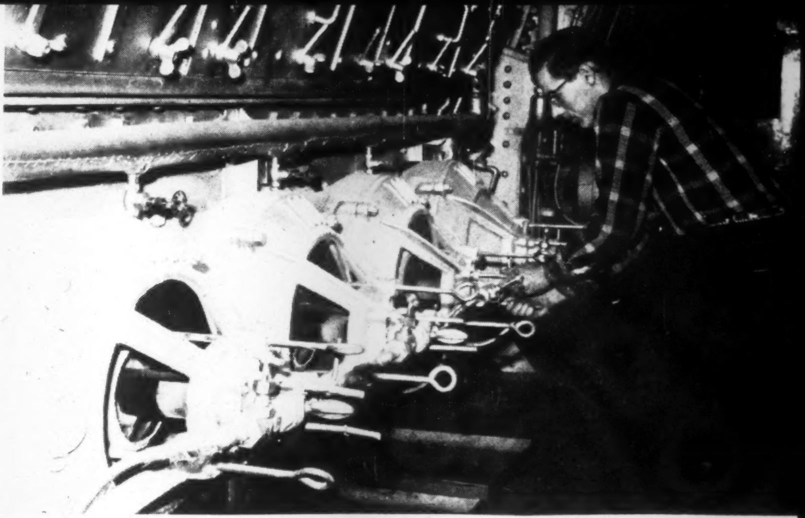
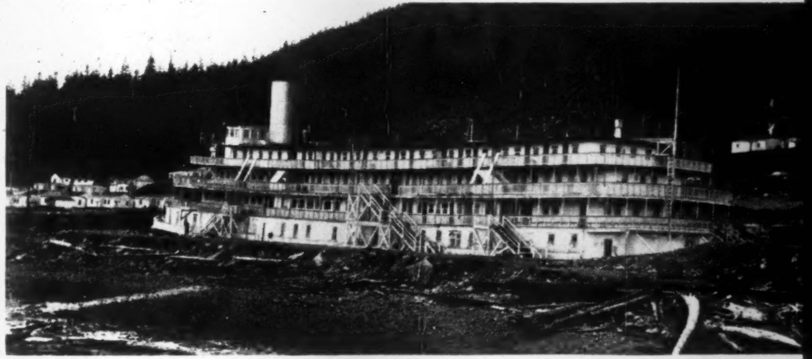


The Delta King, former luxury sternwheeler in San Francisco harbor, now serves as a stationary steam plant for a new industrial community on the Canadian frontier. Steam from her boilers, used chiefly to heat the main buildings, also provides additional capacity for the smelter.

Boilers of River Packet



Heat Kitimat Shore Buildings

THE DELTA KING, a one-time luxury river boat and later a U. S. Navy ferry in San Francisco harbor, now lies beached in the sand of Kitimat Arm, British Columbia, near the huge new aluminum smelter of the Aluminum Co. of Canada.

The 30 year old paddle wheeler is used as a dormitory to house 200 single men employees of the company and as a heating plant for main camp buildings on shore. Steam from her boilers heats a hospital, school, recreation hall, coffee shop, a 1000 man cafeteria, nine large bunkhouses, a women's dormitory, a postoffice, and a department store and also supplements steam requirements of the smelter.

The Delta King and a sister ship, the Delta Queen, were built in Scotland and assembled at Stockton, Calif., in 1926 at a cost of $875,000 apiece.

Beach Ship, Connect Lines to Heating Load

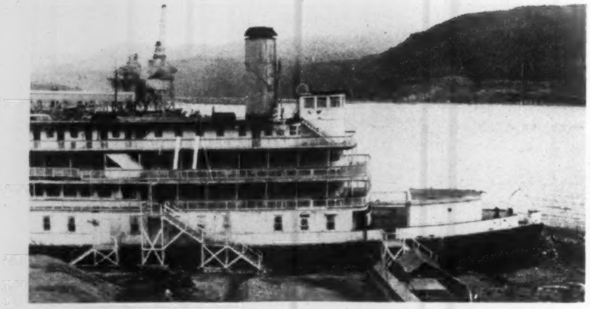
Slated to become an Alaskan fish packer after World War II, the 1837 ton Delta King was urgently needed and bought to accommodate personnel in the early days of construction of the Kitimat project. The sternwheeler's paddlewheel and engines were removed and stored in San Francisco. Her decks boarded up against high waves, she was towed to Victoria for refitting as a dormitory of single and double rooms to accommodate over 200 men.

The shallow draught vessel was then beached at high tide in the place where she now rests. A dike was built up on the seaward side to form a cofferdam. Connecting pipe lines made the boat's steam capacity available to the shore main camp. The cofferdam must be pumped regularly to discharge accumulating water which would otherwise float the vessel, breaking steam, water, and sewer lines.

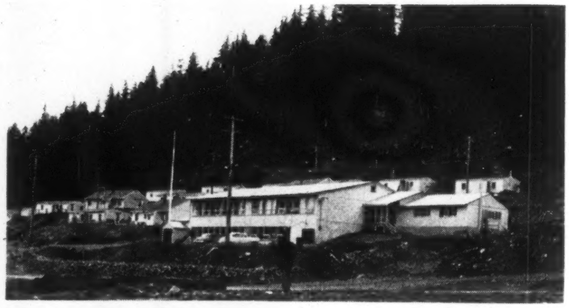
Two Boilers on Diesel Fuel, To Burn Bunker C

The boiler plant consists of two cross drum, straight tube, box header boilers built in 1927. Original working pressure was 200 psig, but present working pressure is 150 psig. Total heating surface is 4140 sq ft.

Fuel is stored in six double bottom tanks in the forward part of the boat, with a total capacity of about 20,-



MAIN STEAM SUPPLY LINE, 4 in. in diameter, extends above ground 400 ft from boat before branching to underground 2 in. line to school and 3 in. line to hospital



TWO STORY SCHOOL of 9820 sq ft requires 500 lb of steam per hr, which, after two stage reduction from 150 psig to 50 and then 15 psig, is converted to hot water.

000 gal. Due to a lack of heavy oil storage in Kitimat, diesel fuel has been burned up to the present time. Recent installation of a 15,000 bbl storage tank for Bunker C fuel gives promise of an early reduction in fuel costs. Suction heaters have been installed, and fuel preheaters are part of the boat's original equipment.

There are two fuel pumps of the duplex type, each 6 × 4 × 6 in.

Burners are mechanical atomizing burners, with natural draft air registers. Four burners are fitted to each boiler. Each burner has a capacity of 25 gph. Fuel pressure is controlled by pressure governor; otherwise, control is manual.

Two feed pumps are installed. One is a vertical simplex, 12 × 8 × 2 in., and the other is a horizontal duplex, 12 × 8 × 12 in. They are controlled by float operated valves in response to hotwell level. Condensate enters the first compartment of the hotwell where makeup is added by manual control, through two banks of loofa sponges for removal of oil, to pump suction, and through two closed heaters to the boilers. Boiler water level is manually controlled.

Boiler water treatment requires addition of phosphate, caustic soda, sodium sulfate, and sodium silicate.

The original d-c electrical system is still in use in the Delta King, supplied by a 60 kw condensing turbine generator unit. The turbine operates at 7200 rpm, driving the generator through a reduction gear at 1200 rpm.

Steam Distribution Lines Above, Underground

The original 33 bed, 9500 sq ft hospital in a frame building over a crawl space and has an aluminum covered trussed roof. Interiors are finished with linoleum floors, plywood walls, and fiber board ceilings. Insulation is 2 in. rock wool batts in the walls and 3 in. batts in the ceilings. In 1956 an addtion doubled the hospital area and bed capacity to a total of 19,000 sq ft and 66 beds. The new wing is similar in construction except that the roof is pitch and gravel.

The steam pipe line to the hospital is 4 in. in diameter from the Delta King to a point 400 ft south, where a 2 in. diam line branches to the school and a 3 in. diam line continues to the hospital. The 4 in. line is above ground, carried on A-frame supports, roofed with plywood. The pipe line is insulated by 2 in. glass fiber and felt. The 2 in. diam line, 300 ft long, and the 3 in. line, 750 ft long, are underground and are insulated. Loops provide for expansion.

At the hospital, 150 psig steam is reduced in two stages, to 50 psig and again to 15 psig. Domestic hot water is supplied by an instantaneous tube and shell heater with no storage. Building heat distribution is by a two pipe hot water system, with a converter and circulating pump for each wing. Wall mounted finned convectors are used.

The heating systems in the school, recreation hall, and coffee shop are similar to the hospital's except that the recreation hall auditorium and the small school gymnasium are equipped with projection heaters instead.

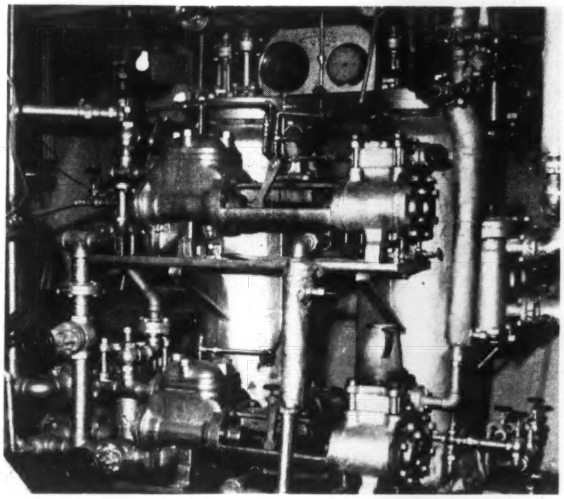
The areas and heat requirements are given in Table 1.

Boilers Also Supplement Steam to Smelter

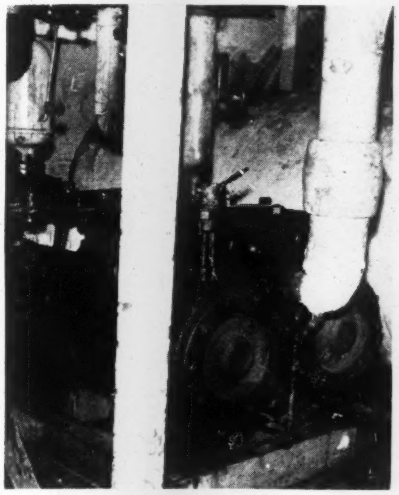
About 4500 ft north of the Delta King, the smelter has been supplied with steam by an 8000 kw electric steam generator and a temporary oil fired standby steam plant.

TABLE 1—STEAM REQUIREMENTS of the Kitimat camp buildings are easily supplied by the Delta King's boilers, whose excess capacity serves part of the smelter's peak demands

Building	Area, sq ft	Steam requirements,	lb per hr
Hospital	19,000	Laundry sterilizers	800
		Domestic hot water	1400
		Space heating	1000
		Total	3200
Recreation hall	9840		500
School	9820		500
Coffee shop	4000		250
Delta King			
Heat and power			1500
Main camp			
Bunkhouses			3000
Cafeteria, Hudson Bay Co. and postoffice			1500
Available capacity to assist in carrying smelter peaks			9550
		Grand Total	20,000



FUEL PUMPS AND FUEL PREHEATERS, two of each, serve the twin boilers. Diesel oil has been fuel, but 15,000 bbl Bunker C tank is now ready



BOILERFEED PUMPS — horizontal duplex shown here plus vertical simplex — are controlled by float operated valve

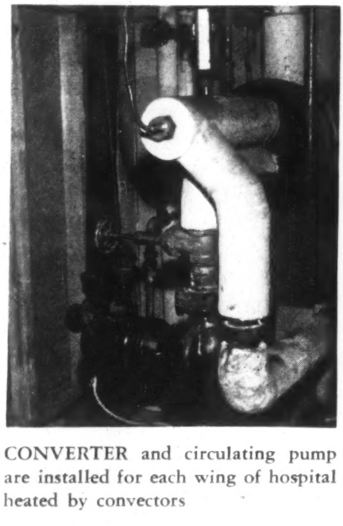
The smelter's steam requirements now exceed the 25,000 lb per hr capacity of the electric boiler.

So, pending installation of sufficient boiler capacity to supply the smelter for some years to come, it was decided to connect the Delta King plant to the smelter system. This was done in 1956.

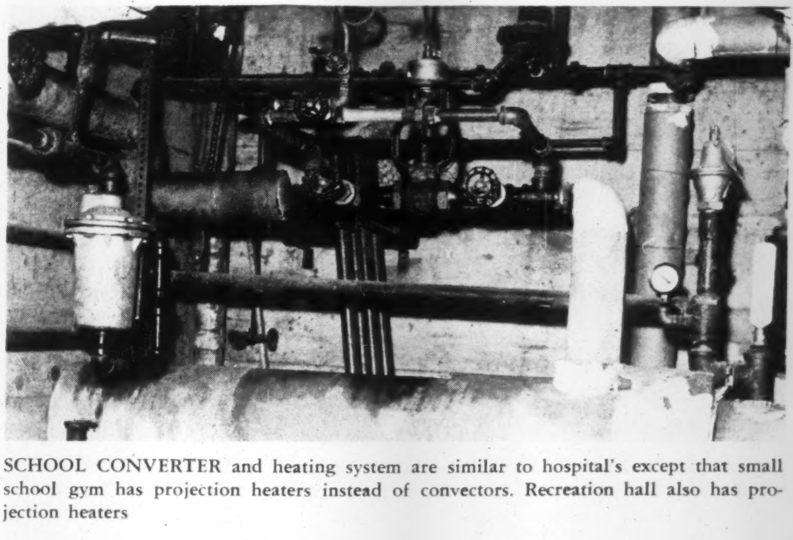
Also, a branch steam line was installed to connect to the main camp buildings, which include nine 68 man bunkhouses, a women's dormitory, a 1000 man cafeteria, a postoffice, and a Hudson's Bay Co. department store. These buildings had been served by a low pressure steam plant which is now shut down.

At present, the electric boiler operates continuously at close to its rating of 8000 kw — 25,000 lb of steam per hr — while the Delta King supplies an average of 8500 lb of steam per hr, and is available with additional capacity to carry the peak loads in the smelter. The limit of the Delta King boilers' steam capacity with present equipment is about 20,000 lb per hr.

After Alcan disposes of the ship, her fate is anyone's guess. The San Francisco Chamber of Commerce has indicated a desire to put her in Golden Gate park as a tourist attraction. She may be scrapped, or used to haul sawdust in the Northwest, or as some businessmen in Vancouver, B.C., would prefer, she might become a floating seafood restaurant in that city. ǂ



CONVERTER and circulating pump are installed for each wing of hospital heated by convectors



SCHOOL CONVERTER and heating system are similar to hospital's except that small school gym has projection heaters instead of convectors. Recreation hall also has projection heaters

JOSEPH H. SPITZLEY, left, is installed as president of MCAA for 1957-58 by his father, Ray L. Spitzley, who served as president in 1931 and as a director for 18 years

"Name Subcontractors in Bid"

. . . urge Mechanical Contractors

HEATING, PIPING, and air conditioning services for commercial buildings, industrial plants, and other large buildings of all types were discussed at the 68th annual convention of the Mechanical Contractors Association of America held recently in Miami Beach, Fla., at the Fontainebleau hotel. Better installation methods and ways for the heating, piping, and air conditioning contractor to get his full share of business were discussed in committee reports, talks, and panel discussions. The importance of apprentice training was also stressed.

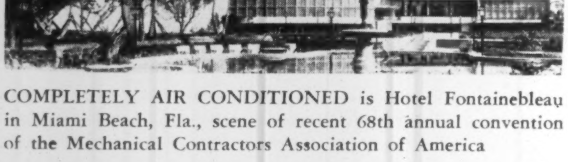
Nearly 800 attended the convention, which was the first time the association met under its new name. It had been known as the Heating, Piping, and Air Conditioning Contractors National Association until May 1956, when the new name was adopted at the convention in Louisville, Ky. This year's convention was arranged under the chairmanship of George Hall of Madison, Wis., president of the association during the past year.

Mr. Hall stated in his report that during the past year arrangements were completed with the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada to have a National Joint Pipefitter Apprenticeship Committee. One of the major tasks of this joint committee that is now underway is to revise the training manuals and other publications previously distributed by the contractors' association. When this is completed, an authoritative manual will be available for training apprentices in all phases of the industry.

Urges Use of American Products

Mr. Hall expressed concern over the considerable imports of foreign welding fittings, copper tubing, and other products used in the installation of heating, piping, and air conditioning systems. These products are being imported at lower cost, and are not always up to the same standards required for the manufacture of U. S. products, Mr. Hall stated. It has been found that some of the foreign pipe welding fittings, for example, possess high quantities of arsenic and sulfur, which cause brittleness, he said. Pressure limitations are reduced as a result of this brittleness, so using these fittings may result in failure and loss to the contractor installing them.

Mr. Hall also reported that there has been some increase in the tendency to bypass the mechanical contractor in the distribution of certain equipment. "There may be areas in which direct selling is justified, but where we must accept the responsibility for the complete installation, we should insist on supplying everything that is part of that system," he said.



COMPLETELY AIR CONDITIONED is Hotel Fontainebleau in Miami Beach, Fla., scene of recent 68th annual convention of the Mechanical Contractors Association of America

Competition to Continue

Lloyd B. Gruman, Jr., secretary for the national association, reported that the intense competition that has accompanied the high volume of construction work is expected to continue. Mr. Gruman said only the more efficient, better financed, and expertly managed firms will be able to survive the profit squeeze. Little or no increase in labor productivity is anticipated, so we must look to new methods, new materials, new processes, and new machines to increase the efficiency of operations.

Name Subcontractors in Bid

The Federal Construction Contract Procedures Act, H. R. 7168, is awaiting Congressional action, according to Fred Williams, Boston, chairman of the legislation committee of the national association. Previous bills have been before the Senate and House which would require general contractors doing federal work to name the subcontractors in their bids, but have not been passed.

General contractors have always maintained that they are handicapped because of the receipt of sub-bids at the last minute and too late for them to finalize their bids before submitting them to the governmental agency.

The low bid for a category is often among those filed at the last minute, yet the general contractor feels compelled to use it in order to remain in compeition. The general contractor complains that he is given no opportunity to investigate the integrity, ability, and financial condition of the mechanical contractors who submit low bids. The Associated General Contractors of America have agreed to the following provisions which were not included in the previous bills:

a) A provision for the general contractor to have five days, not including Saturdays, Sundays, and Federal holidays, after opening the bids to change mechanical contractors without the necessity of accounting to the government.

b) A provision that the general contractor, instead of naming the mechanical contractor in a particular category, may state in writing that he has solicited bids from at least three responsible contractors and has received no responsible bid. He must further file a list of the names of all those from whom he has requested or received bids. If he does file such a statement he must, within five days after the opening of the bids, notify the governmental agency in writing the name of the mechanical contractor with whom he will contract for the performance of such category.

Mr. Williams pointed out that for the first time the mechanical contracting industry is being recognized by the federal government. In this revised bill, the mechanical contractor will be considered by the federal government as separate from subcontractors in the ordinary sense and will provide them bidding protection. As a result, it is felt that closer cooperation and better understanding between the AGC and the mechanical contractors will be experienced in the future.

GEORGE NACHMAN, left, receives MCAA special award from George Hall, president of MCAA, in recognition of years of service to industry as head of boiler output committee

Boiler Ratings Discussed

According to the report of George P. Nachman, chairman of the boiler output committee, the 1956 issue of the "Net Load Recommendations" is a reference for contractors, engineers, municipalities, FHA, and other branches of government. It lists the ratings of boilers,

Headquarters to Remain in New York

A RESOLUTION was defeated which would have transferred the association's headquarters from New York City to Washington, D. C. The matter of shifting the headquarters from New York City had been discussed previously, and at two previous conventions resolutions asking for the move had been approved.

The move had been questioned after last year's convention in Louisville, and as a result, the directors of the association decided to conduct a mail poll of the membership on the matter. The results indicated that the members were in favor of keeping the offices in New York City.

The proponents of the move felt that more effective relationship between the association and other agencies could be developed in labor and legislative matters which are centered in Washington, D. C. To achieve this purpose without moving the headquarters, the board of directors voted to create a new staff position of assistant secretary. This will enable Mr. Gruman to devote more of his time to these matters.

boiler-burner units, convectors, baseboard, and finned tube products of most manufacturers.

A new section to be added to this publication will include the ratings of fan-coil units which use both hot and chilled water for year 'round air conditioning. Some confusion exists in the present ratings, the methods of testing, and field performances of these units, said Mr. Nachman. The boiler output committee will be studying this problem in the coming months in cooperation with other associations in the industry.

Mr. Nachman has requested that he be relieved of his chairmanship of the boiler output committee on which he has served for the last 13 years. Special recognition of Mr. Nachman's untiring and devoted efforts as chairman of this committee was cited. He was presented with a certificate by George Hall, as president of the national association, which commended Mr. Nachman for the monumental service he has rendered the association.

Joseph C. Fitts Honored

The Association's distinguished service award for 1957 was presented to Joseph C. Fitts in recognition of his outstanding and loyal service of 38 years to the association. As secretary of the association he demonstrated leadership in the development of standards and apprenticeship programs and in many committee programs. Mr. Fitts was cited for giving freely of his own time and energy to aid and upbuild the national association.

Since his retirement as national secretary, he has continued his service as consultant to the association, as secretary of the National Certified Pipe Welding Bureau, and as a member of the National Joint Pipe Fitter Apprenticeship Committee.

New Officers, Directors Elected

Joseph H. Spitzley, president of the R. L. Spitzley Heating Co., Detroit, Mich., was elected president of the National Association, succeeding George Hall, president of Hyland, Hall & Co., Madison, Wis.

The new vice president is Horace E. Wetzell, president of Smith & Oby Co., Cleveland, Ohio. The newly elected treasurer is William P. Scott, Jr., president of Scott Brothers, Oakland, Calif.

Serving the National Association as newly elected board of director members for three year terms are Douglas W. Bell, Denver, Colo., Merrill W. McKinstry, Seattle, Wash., Frank Player, Atlanta, Ga., Walter S. Schukai, St. Louis, Mo., Grant J. Hayes, Indianapolis, Ind., and Al C. Lederer, Houston, Tex.

Los Angeles Next Year

The association's 69th Annual Convention is to be held in Los Angeles on May 6-9, 1958.

Downhill Pipe Welding to Get Emphasis, Contractors Decide

. . . other topics aired at recent convention include aluminum pipe welding, Nautilus pipe failures, and marking pipe and fittings with the type of welded joint

An active panel discussion took place on the subject of downhill welding at the 68th convention of the Mechanical Contractors Association of America held recently in Miami Beach, Fla. H. E. McGregor of Cambridge, Mass. raised the question, why was downhill welding not used more when it made possible greater production. Professor Robert S. Green of Ohio State university, who serves as technical consultant for the National Certified Pipe Welding Bureau, pointed out that Standard Procedure Specification No. 10 for metal arc downhill welding of carbon steel pipe, valves, fittings, and flanges had been developed for the use of all piping contractors. Professor Green said it was up to the individual contractor to use it and to encourage his pipe welders to use the method. The Pipe Welding Bureau could not promote the use of the method.

Determine Method from Application

As others commented on the subject of downhill welding, it was brought out that the method of downhill welding could not be applied in some cases where uphill welding was suitable. Therefore, it is not feasible to think in terms of downhill welding replacing uphill welding

EAGER DISCUSSION was mark of panel session on downhill pipe welding

for all applications. It was agreed that downhill welding made it possible to complete more welds per welder per day and that greater emphasis should be placed on training pipe fitter apprentices in downhill welding and where the method may be used.

J. G. Pannel of Newport, Ky., asked about the recent change in the American Society of Mechanical Engineers' Welding Qualifications for stress relief of pipe welds. Professor Green pointed out that the new ASME Code changed the minimum pipe wall thickness from $^3/_8$ in. to $^3/_4$ in. for which stress relief is required. All pipe wall thicknesses of $^3/_4$ in. and above require stress relief of the pipe weld.

Use A-C or D-C for Aluminum Pipe?

A question was asked about welding aluminum pipe, and whether helium shielded tungsten arc welding with d-c current or argon shielded tungsten arc welding with a-c current produced the best welds. Professor Green reported that Standard Procedure Specification No. 5 for helium shielded tungsten arc welding of aluminum pipe, fittings, and flanges was developed after considerable study on the matter.

At first the Pipe Welding Bureau considered the a-c current method and argon shielded tungsten electrode as the way to weld without high powered welding equipment in out-of-position welds. Because the a-c and argon methods cleans the weld as it is made on account of the current being one half cycle out of phase, many felt that this was the answer before Procedure No. 5 was developed. However, when the d-c current and helium shielding were tried, it was found that welds could be made more economically and higher quality welds resulted. The straight polarity of the d-c method did not clean the weld as it was made, however. A slag scum is deposited as the weld is made with the d-c method which may be scraped off easily with a wire brush. After this brushing a clean weld results. Some pipe welders and contractors have thought that this d-c method of welding was inferior because the weld did not look clean as it was being made.

Professor Green pointed out very clearly that in this case it does not necessarily mean that the weld is of higher quality just because it is cleaner during the welding process. It has been proven that the d-c method with helium shielding is more economical and that higher quality welds are produced which provided the basis for Procedure No. 5.

Mis-mated Joints Cause *Nautilus* Pipe Failures

Peter J. Davis, Chicago, reported that the pipe failures which occurred in the U.S.S. *Nautilus*, the first atomic powered submarine, recently had been traced to different types of pipe joints being welded together. It has been determined that the pipe welders selected fittings and pipe that were not mates and then welded them, not realizing the seriousness of the situation. This occurred, said Mr. Davis, because the pipe and fittings were not identified properly. He pointed out as an example, butt weld joints were welded with lap weld joints, which caused difficulty.

A recommendation to have all pipe and fittings marked with the type of welded joint was proposed by the Mechanical Contractors Association of America to the American Standards Association for adoption in the piping code after having the approval of the U. S. Navy, U. S. Air Force, and the U. S. Army. An industry conference was held which recommended that an ASA project on marking of metals be initiated. The opinion and vote for quick acceptance of this project by the ASA were seriously divided. Definite action will probably not be taken very soon because of the many problems such as methods of marking, research required, opposition on the part of the mills and warehouses, and opposition from major users as a result of cost increases because of such marking. ⌗

Schoemann Speaks on Mutual Goals

. . . at recent mechanical contractors convention

PETER T. SCHOEMANN, president of the United Association, announced 10 major standards to be met as a condition of approval of a joint industry program

PETER T. Schoemann, general president of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry, spoke on apprentice training, jurisdictional disputes, joint funds, and other items of common interest at the convention of the Mechanical Contractors Association of America. He praised the positive position taken by the contractors association in establishing a five man apprenticeship committee to meet with UA officials and to plan ahead for future training needs.

Mr. Schoemann stated that disputes should be prevented before the industry is damaged by strikes and lockouts as these are outmoded methods of producing agreement. He hoped that continued progress can be achieved in settling all differences peacefully and constructively for the welfare of the contractor and the journeyman.

The matter of jurisdictional disputes was also discussed by Mr. Schoemann. He said that so long as industrial and engineering methods develop and change, there will continue to exist honest differences of opinion as to whether a certain new process should be assigned to one craft rather than to another. For settling these matters, the contractors and the unions in the building trades have established the Joint Board for the Settlement of Jurisdictional Disputes. These jurisdictional issues are not confined to differences between craft unions as to who should do the work. They also spring from methods used by contractors to perform the work and from assignments made not only by heating, piping, and air conditioning contractors but by general contractors as well.

Mr. Schoemann suggested that all contractors be alert to see that the contract covers all specifications for work rightfully theirs. Whenever the contract fails to cover all of the work, he said, then the jurisdictional troubles will rapidly increase in number and frequency.

Mr. Schoemann also set forth 10 standards which the UA has recently adopted for administering joint industry funds. He pointed out that in all cases the UA members and the contractors have been partners in founding these funds. Likewise, they are expected to police the payments into these funds. Therefore, a committee was appointed to examine and report on these funds. This committee proposed 10 major standards to be met as a condition of approval of a joint industry program by the executive board of the UA.

1) National Contractors and National Agreements. That contractors who are in agreement with the UA (National Agreements) will not be required to pay any monies into joint industry board funds. Such contractors, however, will be required to pay into local health and welfare funds, pension funds, paid vacation and paid holiday funds, where such funds exist under the terms of a local collective bargaining agreement, and they will also be required to pay into the national apprenticeship fund.

2) Joint Fund Trustees Required. Joint industry board funds must be jointly and equally administered by trustees of a local union and local employers under a bona-fide legal declaration of trust.

3) Corporate Trustees Prohibited. Industry funds should not be created or established or administered through a corporation.

4) No Support for Local Unions or Employers' Associations. Industry board funds are not to be allocated, nor are they to pay for the maintenance and operation of either a local union or an association of employers.

5) Semi-Annual Audits Available to Members. Industry board funds are to be audited at least semi-annually by a recognized, certified public accountant and such audits are to be available to the members of both the Employers' Association and the local union.

6) Separate Trusts and Trust Accounts. Industry board funds and payments are under no circumstances to be intermingled with any other type of funds which may be in existence in a given locality and must be kept in a separate trusts and trust accounts.

7) No Salaries for Joint Trustees. Trustees of joint industry boards, whether employer or employees, are not to be compensated except to the extent of out-of-pocket expenses.

8) Representation for Independent Contractors. Provision should be made to give representation on joint industry boards to independent (non-association) contractors.

9) Impartial Umpire to Break Deadlocks. Industry board trust agreements must provide for the selection of an impartial umpire who would break deadlocks that may occur.

10) Declaration of Trust to State Trust Purposes. The declaration of trust should set forth in detail the objectives and purposes for which the funds are to be expended; and these purposes are trade promotion aims and objectives only.

Mr. Schoemann concluded by stating that these 10 standards clearly indicate that the UA has no thought of placing industry funds in a "strait jacket." Instead, as under No. 10, the UA merely requires that the purpose and objectives of the funds and programs to be set forth in detail in the original trust agreement, he said. ‡

Report New Methods for Air Conditioning Large Buildings

. . . including improved volume control, larger heat transfer surface, the staged cycle, and a three pipe heat pump system

ONE of the lively panel discussions that took place at the recent convention of the Mechanical Contractors Association of America centered around a new method of air conditioning large buildings proposed by A. I. McFarlan, president of A. I. McFarlan Co., air conditioning contractors in New York City.

Mr. McFarlan reflected the changes that have taken place in the last 20 years with reference to the manner in which air conditioning contracts are handled. He said before 1940 a large percentage of the air conditioning business was handled by companies acting as engineers and contractors. For many reasons, this picture gradually changed. Manufacturers divorced themselves from contracting, and contractors divorced themselves from engineering. At the present time, Mr. McFarlan cited two voids, in his opinion, which merit consideration and improvement.

1) The divorcement of engineering and contracting leaves a division of responsibility.

2) Manufacturer responsibility when limited to the performance of the various individual component parts of an air conditioning system, divorced from the responsibility of overall performance and excluding overall selection of component parts, results in a reduced incentive for a better overall air conditioning system.

He said customers generally look to the contractor for the ultimate performance, regardless of limited responsibility. Also, it is the contractor who generally bears the brunt of the customer's complaints about performance.

This being the case, the experienced contractor is more and more faced with a solution for performance even though he may not be obligated. This is working out in many ways which tend to circumvent the divorcement of responsibility which has become prevalent in the past 20 years. Many contractors find acceptance of performance responsibility less unprofitable than avoiding the issue.

Five Methods Have Been Used

It is probably this thinking which over the last five years has caused us to gradually break away from the beaten path of tradition, reported Mr. McFarlan. The more we deviate, the more attractive solutions we find possible. In their order of development we have used:

1) A greatly improved means of volume control for individual temperature regulation.

2) A means of humidity control, combining volume control to eliminate the necessity of reheat in most comfort air conditioning installations.

A. I. McFARLAN, New York contractor, a member of the air conditioning panel, emphasized contractor's role in developing new ideas and methods

3) A method of coil selection consisting of a design for air coils mainly involving more surface and somewhat different circuiting to reduce the quantity of water circulated, thus increasing the water range across the coil. This was originally used only in conjunction with a method of well water pre-cooling, which decreased the quantity of well water required. With refrigeration applied directly to the well water system this substantially decreased the size of the refrigeration plant for the same air tonnage.

4) Having considerable experience with wide range coils, the principle of the wide range coil was applied to other than well water systems. Compressors were staged to remove the heat in steps, thus reducing compression ratios, increasing volumetric efficiency, and reducing horsepower per ton.

5) The wide range coil and staging naturally evolved into a three pipe heat pump system.

"It is the last two items in the evolution which I believe should particularly interest other contractors who are faced with the problems of furnishing more and more equipment to solve the problems presented. These two combinations have the most unusual quality of solving problems, saving space, reducing horsepower, and at the same time, reducing first cost," he said.

Here Are the Problems to Be Solved

Thanks to air conditioning, practically every large office building built today has an interior core system which usually did not exist in such buildings built more than 15 years ago. Air conditioning has been the means of utilizing interior areas which formerly had ventilation requirements, generally requiring windows in courts. Large interior areas today are often completely enclosed with peripheral office partitions.

Formerly the problem was to heat the building in winter and cool it in summer, but now the biggest problem is to cool the interior and simultaneously heat the exterior. This has generally been accomplished by the use of outside air for cooling purposes during the period when the outside temperatures are below 55 F. Unfortunately however, in most areas we have many days during the winter when the outdoor temperature is above 55 F. This means that after the cooling tower is shut down for the winter season, the interior of the building becomes unacceptably hot on warm days.

Air at 60 F will produce about 80 F inside the building in the summer. With the same interior load, it is obvious that approximately 50 F air is required to produce 70 F inside during the winter. When 50 F air does not exist outside, trouble is encountered unless the refrigeration equipment can be operated. This is usually impossible after the cooling tower has been drained, unless the tower is refilled. Also, this involves draining the tower at night to prevent freezing. The labor costs are high, and the inconvenience is such that frequently buildings are left warm.

Buildings Being Built Tighter

There is another problem which is becoming more and more prevalent in shopping centers, large department stores, and factories with large air conditioned interior areas. Buildings are being built so tight that it is impossible to force more than a limited quantity of outside air into the conditioned space. Many modern buildings are now installing double fans to relieve the pressure during the season when outside air is used above the normal ventilation requirements. This also requires automatic dampers and a means to exhaust the air. Large buildings, especially multistory buildings find difficulty in getting rid of this air. Frequently the very tall buildings have a large shaft through the building for 100 percent outside air to be circulated, and another shaft to exhaust the air after it has reached room temperature. This loss of valuable space is costly, and the loss of heat in the exhaust air is equally uneconomical, he pointed out.

Use the Closed Cycle Year 'Round

Mr. McFarlan reported on the solution his organization has developed which consists of elimination of the double fans and using the same apparatus with the correct quantity of outside air the year 'round. Hot water and cold water are both brought to a single three-way valve ahead of the wide range coil. The coil surface is sufficiently large, and the circuit is such that for between season use, the water will leave the coil at substantially the same temperature whether it was initially warm water for heating or cold water for cooling when entering the coil. In this way a common return can be used.

By supplying either hot water or cold water to the same coil through the same automatic valve, the thermostat can call for heat or cooling and be satisfied without the operation of a summer-winter switch or other means of manual control. The same system is used year 'round, he said.

Since we now have a common return line, the same pump can be used for both heating and cooling. This is another saving in first cost and operating expense.

In the closed cycle, after discharging through the pump, the water passes through a water cooler and this source of water goes to one side of the three way valve, through a chilled water line.

The main point of difference in the closed cycle and normal cycle is that a second condenser is in parallel or in series on the refrigerant side with the usual condenser. When the normal condenser is inoperative, the second condenser condenses the refrigerant which has obtained its heat from the water cooler. The second condenser is supplied with water from the discharge side of the single heating and cooling water pump, and is the source of water to the other side of the three-way valve ahead of each coil. In this hot water line on the discharge side of the second condenser, there is a steam converter which is provided with steam from a boiler. Any time the three way valve on any system is fully open on the hot water side and the thermostat is not satisfied, the steam valve for the converter will bring on an increasing amount of steam to the converter, which raises the temperature of the water above that obtainable with the heat pump condenser.

Whenever the water becomes too warm, the thermostat will sense overheating and tend to close the three-way valve on the heating side. This first reduces the steam to the converter before it tends to reduce the hot water flow. Ultimately, the system is back on the heat pump entirely.

If the system is operated on a day when substantially more cooling is required than heating, then the condensing temperature of the refrigerant tends to rise above a set point, which rings a bell and this requires the cooling tower to be put in operation. This can only happen on a day when little or no heat is required in the building, and of course this would be at the time of the year when it would not be objectionable to operate the cooling tower, he pointed out.

Heating can be furnished if necessary to warm the building in the morning. When lights are turned on in the interior, or if other internal heat loads develop, cooling becomes available at any time of the year, without regard to outside temperatures or summer-winter switch positioning.

This cycle provides automatic start and stop of compressors which dictates to some extent the type and size of the refrigeration plant. However, when the building is hot and the chilled water has risen to 80 or 90 F throughout the lines, the pulldown period in most present plants requires reduction in capacity of compressors at the time the greatest capacity is desired in order to make them stay on the line and not kick out on overload or high condensing pressures. This is due in turn to the fact that when compression ratios of compressors are reduced, the capacity of the refrigerating unit is increased if sufficient heat transfer surface is provided to dissipate this increased heat removing capacity.

Since the economy of the staged cycle results from operation at maximum suction temperatures and minimum condensing temperatures, the heat transfer surface must be provided for the increased capacity obtained. Combined with the fact that power requirements reach a peak, then fall for reduced compression ratios, not only is it possible to obtain more capacity for less horsepower but also a non-overloading cycle is obtained. It would appear that this feature cannot be matched with single stage equipment without adding more heat transfer surface than is now provided. Even then, economy, flexibility, and reduced demand charge favor the staged cycle, he said.

The Staged Cycle; How It Works

Staging of compressors is an evolution of the wide range coil. A typical performance curve of either centrifugal or reciprocating compressors clearly brings out the increased tonnage available when heat is removed from an evaporator at a higher than normal evaporator temperature. There is also some gain in volumetric efficiency whenever heat is rejected into a condenser at a lower condensing temperature. The horsepower required for a compressor is directly proportional to both the volumetric efficiency and the difference in heat between evaporator temperature and condensing temperature.

For practically all comfort conditions, it is possible to save upwards from 20 percent in compressor horsepower by staging in conjunction with a wide range coil, as compared with single stage operation. For systems requiring more than normal quantities of outside air and especially 100 percent outside air installations, such as used for research laboratories and industrial processes, the reduction in horsepower is almost on the phenomenal side. It is frequently possible for this type of operation to reduce the compressor horsepower as much as 40 to 50 percent, he said.

There is sometimes the feeling that this gain exists only for the full load, and there is no benefit at partial load. This is completely contrary to the facts as there is always a gain.

Another saving possible with the staged cycle is due to the fact that only one of a possible three or more compressors is used during less than full load operation. The saving in demand charge compared to a single stage operation is very perceptible, sometimes amounting to a substantial percentage of the entire operating power cost between seasons.

Volume Controls Relative Humidity

There is an advantage of this type of volume control which has been found with respect to humidity control, he said.

If we reduce the air quantity substantially, we automatically increase the ratio of latent to sensible cooling.

At less than peak dry bulb temperatures, at which time maximum humidities will always occur, the air quantity will be reduced automatically. This means that we now have a solution to our problem in that the latent removal increases and the sensible heat decreases, which is exactly what is desired.

Compared to this, it is common in the air conditioning industry to add reheat, which is exactly the opposite of what is desired. With reheat, sensible heat is added artificially, which must be removed on the next cycle of the air without any gain whatsoever in the latent cooling — except to change the ratio by the artificial adding of sensible heat.

Combined with the technique of varying water temperatures there is another advantage. Any time the water temperature entering the coil is decreased, the ratio of latent to sensible cooling is increased. In other words, by increasing the water temperature to the coil we secure more sensible tons in relation to the latent load, which is what is desired for peak dry bulb days, providing sufficient coil surface is available to handle the load for peak conditions. When the high humidity load occurs, which is generally accompanied by a reduction in sun effect, then the water temperature is again reduced automatically.

The performance in a 19 story office building where both the volume control and zone-reheat system are installed from the same central system, and with the same amount of coil surface for each floor, indicates that about 5 F lower temperatures can be obtained on peak days with the volume control compared with the zoned reheat system, Mr. McFarlan reported.

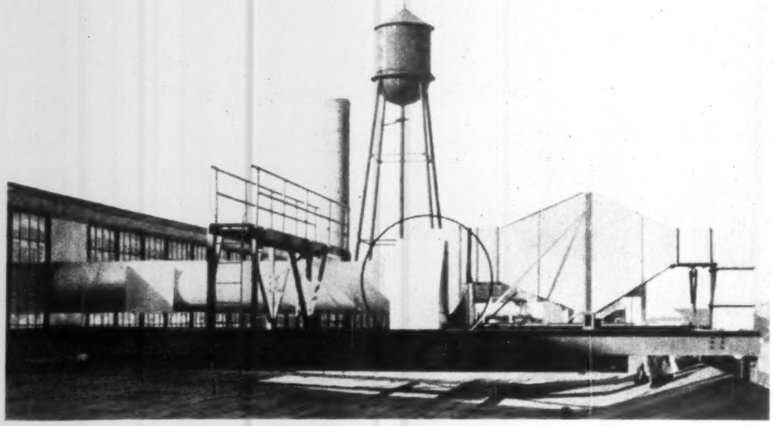
Patents Are Pending

All of these features are covered by patent applications, Mr. McFarlan said. He continued, "It is our intent at the present time to license these methods to reputable contractors, especially those who have the experience and engineering personnel to analyze the requirements and solve the problems with the proper and efficient usage of equipment."

It is hoped that engineers will ultimately specify these methods, and cooperation is offered with assistance to be sure that the methods are properly applied. There are a great many differences between these methods and the usual application of air conditioning equipment and until these differences are understood and appreciated, there will be a certain inertia to be overcome, he said. It is not advocated that these methods can be a panacea to all problems in the industry, nor necessarily applicable to every job. Properly used, however, they do solve a number of problems, and almost always save space, reduce operating expense, result in greater automation, reduction in labor for operating, and frequently reduce the first cost for equal results, he said. ‡

Big Fans Ventilate Auto Body Plant

. . . 36½ in. diam wheels have single inlets

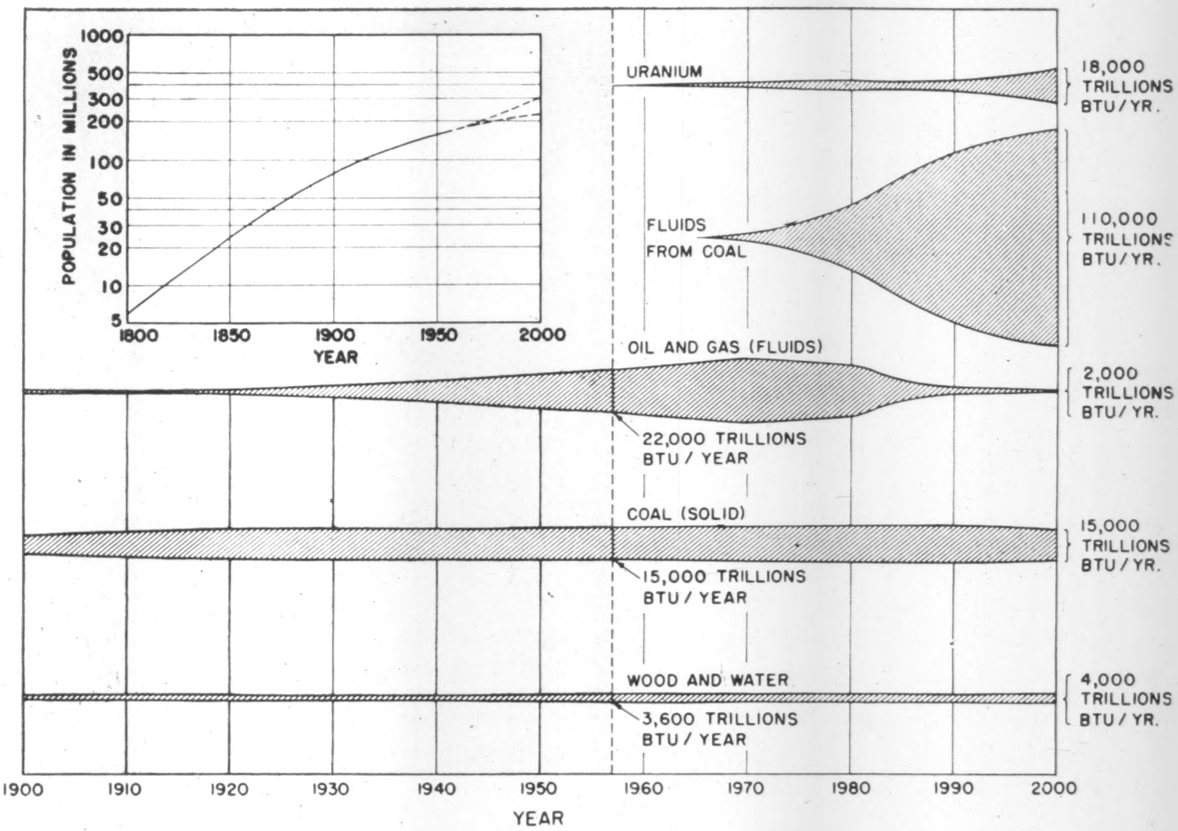


A HUGE backward curve blower was recently installed on the roof of one of the nation's largest automobile body plants to draw air from the ceiling of the punch press room and discharge it into the press pit which is below ground level, according to The Peerless Electric Co.

The fans have a 36½ in. diam wheel, single width, single inlet, Class II construction of backward curve design. They are equipped with ring oiling bearings and 15 hp totally enclosed ball bearing motors. The capacity of these units is 17,600 cfm at 4 in. static pressure, with a fan speed of 951 rpm, 2300 fpm outlet velocity.

The fans are applied to cooling the press pits where temperatures rise to 110 F. The filtered air is delivered through ducts into the pits. Automatic temperature control consisting of damper motors prevents the fans from discharging air into the press pit below 60 F. Air from the second floor ceiling of the press room can be delivered 100 percent to the press pits, or 100 percent outside air can be used, or any portion of outside or recirculated inside air.

Wilbur Watson Associates of Cleveland, Ohio, were the consulting engineers. Quiggan & Son, Inc. were the contractors. Lester Dickens was the engineer in charge. ‡



1 ENERGY CONSUMPTION in the U. S. is expected to follow the pattern shown here, as predicted by Lawrence R. Hafstad, in the January 1957 issue of *The Scientific Monthly*. Note that figures for solar energy are not included

Despite constantly increasing demands for energy in the U. S. . . .

Here's Why Solar Heating Lags

- ***large capital investments are required***
- ***integration of collector into building architecture poses problems***
- ***fossil fuels are still relatively abundant***

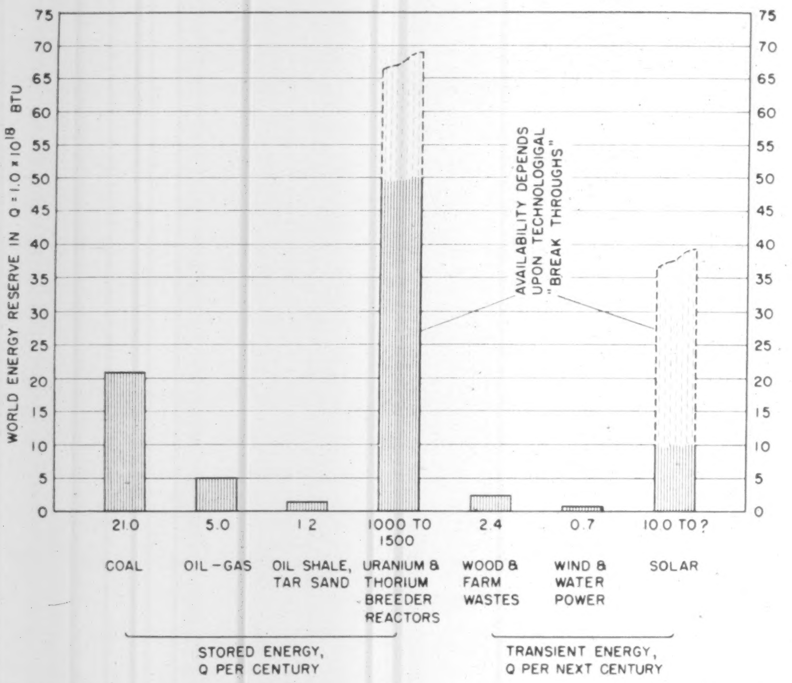
BY R. C. JORDAN
Professor and Head
Dept. of Mechanical Engineering
University of Minnesota

REVOLUTIONARY CHANGES have occurred in control of environment in the last 50 years. The changed pattern of fuels for space heating, the improvement in control, and more effective heat distribution systems, as well as the rapid expansion of summer cooling have not only increased indoor comfort but extended the limits of habitable climate zones.

But if the U. S. continues to improve its standard of living, its energy demands for space conditioning will also increase. Our burgeoning population will require proportionate increases in space heating. And our increasing standard of living will continue to expand the applications of space cooling.

At present, space conditioning uses about 30 percent of all the energy consumed in the U. S. and will probably remain at about that proportion for the next century. However, these energy demands are but a part of the total energy picture. The total world demand for energy is

This article has been adapted from a paper presented by the author before the recent 19th annual American Power Conference in Chicago.



2 WORLD ENERGY RESERVES available at costs no greater than twice current, as shown here, indicate that our main sources of energy will eventually be atomic and solar

the product of the population growth curve and the curve of energy used per unit of population.

The current world population of approximately 2.4 billion will probably increase to 5 to 8 billion by the year 2050. The current U. S. population of 168 million may increase to 300 million by the year 2000.

The world's energy consumption in 1953 was estimated by N. B. Guyol of the United Nations Secretariat during the International Conference for the Peaceful Uses of Atomic Energy at Geneva in 1955 as equivalent to 23 billion kwhr. It was further estimated that this figure would be tripled by 1975 and increased eight fold by the year 2000.

These fantastic energy demands are certain to tax the ingenuity of scientists and engineers as well as politicians. There is probably no single factor which controls more the rate of technological advance of nations and the resulting standards of living than the productive utilization of energy.

The stake in the Suez canal crisis is, to a minor extent, this important inland waterway. But of much greater concern are the vast petroleum resources of the Middle East. The U. S. is currently the world's biggest importer of oil, and even Canada is still importing, although production is growing.

Evaluate Energy Consumption

The sources of energy which will be used in the future in the U. S. for space conditioning will depend upon:

a) The relative cost of fuels.

b) The ease of adaptation of the fuel to space conditioning.

c) The capital investment of equipment necessary for fuel utilization.

In order to predict the types of equipment most likely to be used for space conditioning, an initial evaluation is needed of the probable primary energy consumption, as shown in Fig. 1. The data indicates the following:

- In all probability, the uses of solid coal will continue at about their present demand.
- Wood and water will continue to provide but a minor contribution to the potential needs.
- Oil and gas fluids, currently our dominant energy sources, will continue to expand for another decade or so, but their limited availability will eventually make them more valuable as raw materials for the chemical industry. However, fuels with the adaptability of the oil and gas fluids will be so necessary that conversion of coal to fluid fuels is likely to be initiated within the next decade and will probably be the dominant fuel in this country by the end of the century.
- Uranium and thorium, with energy assets potentially totaling vastly more than all of our other combined energy resources with the exception of solar energy, will almost certainly emerge at some point in the future to become our dominant energy supply.

However, the relative abundance of fossil fuels in the U.S., particularly coal, reduces the incentive for the rapid development of electric power from uranium and thorium fuels. With an assumed value of 8 mills per kwhr as a current cost of generating electric power, about 25 percent of this figure would represent the cost of the fuel itself. In those countries where fuels are more costly, nuclear fuels are of much greater current economic interest.

- The eventual position of solar energy in competition with other energy sources is much more nebu-

TABLE 1—HEAT PUMP SYSTEMS in the Southern U.S. shifted from water to air heat sources from 1946 to 1956

	Air source, percent		Water source, percent	
Years	Residential	Commercial	Residential	Commercial
1946-1956 cumulative	29	7	71	93
1955 only	67	21	33	79
1956 (through June)	77	66	23	34

lous. The potentialities, however, are so vast that its ultimate utilization in large scale is almost certain. The stored and transient world energy reserves available at costs no greater than twice current are shown in Fig. 2.

Currently the total annual energy consumption of the world is approximately 0.1Q (where $Q = 1.0 \times 10^{18}$ Btu. or the heat equivalent of about 38 billion tons of bituminous coal). This is 10 times greater than in 1850, and it is variously predicted that between 1950 and 2050, 80 to 1000 of energy will be required.

If these estimates can be trusted, our eventual energy supplied will be from uranium and thorium breeder reactors and solar energy. Any applications which can be made of solar energy will result in conservation of our limited stored energy fuels, including atomic.

Seek Solar Breakthroughs

Solar energy is the most difficult energy source to adapt directly to useful purposes. The seasonal and diurnal variations of the sun are accurately predictable, but the meteorological variables such as atmospheric absorption, smog, and cloud patterns, while statistically predictable, greatly complicate the picture. Since the supply varies, storage of solar energy before its use or storage of the end effect resulting from its application is necessary.

In the U. S. the adaptation of solar energy as a power source is likely to be negligible in the foreseeable future unless additional breakthroughs occur in the direct conversion of solar to electrical energy.

However, the adaptation of solar energy to space heating is much more feasible both for direct space heating and as a heat source for heat pump systems. The prime deterrents currently are the capital investment needed in equipment and the further development of thermal storage systems which will permit the concentration of large quantities of heat storage in a comparatively small space.

During the past decade, both residential and commercial heat pump systems have emerged from the status of experimental curiosities to that of practical devices.

Heat Pump Gaining Rapidly

By early 1956 there were about 8000 residential and commercial heat pump systems in the U. S. Roughly 45 to 50 percent of these were in the Gulf states. Here the demand for cooling is much greater than for heating so that many of the heat pump systems might be regarded as of questionable design and would probably not be economically usable farther north, where heating becomes of more nearly equal importance to cooling in space conditioning considerations.

However, another 20 to 25 percent of the heat pumps were in an area north of the Gulf band, south of the Chicago latitude, and east of the Nebraska-Kansas-Oklahoma eastern borders. Another 20 to 25 percent were in the Far Western states and the remaining 5 or 6 percent scattered throughout the Mountain, Prairie, and Northern states.

Several heat sources may be adapted for use with heat pump systems but not with equal facility.

- The earth as a heat source is widely available, but the cost of installation of ground coils is high. Further, their design is difficult since it involves knowledge of the soil structure and a prediction of the effects of water and vapor migration.
- City water, well water, and waste water may all be used as a heat source or sink. Local costs, disposal problems and use restrictions affect city water and often well water. In addition, a degree of uncertainty as to location, temperature, and characteristics of well water often exists, and the cost of drilling is sometimes substantial.
- The air offers many advantages as a heat source for small systems. The units are comparatively easy to design as selfcontained factory assembled systems. The disadvantages concern the source temperature variability and coil frosting.
- Solar energy as a heat source is only beginning to be explored, and comparatively little experience is yet available.

The shift from water to air heat sources for heat pumps, at least in the South, is shown in Table 1, based on the experience of the Florida Power Corp. and the Georgia Power and Light Co. These figures are borne out by the studies of others.

The largest heat pump system in the world was recently installed in the Southdale regional shopping center near Minneapolis. This system, which uses well water as the heat source, was discussed in the January 1957 HPAC. Another installation, combining a heat pump with a direct solar heating system, was discussed in the October 1956 HPAC. Articles on other heat pump installations using other heat sources have appeared in other recent issues of this magazine.

Solar Heating Follows Pattern

Solar space heating systems in this country are, today, in much the same position as heat pump systems were in the late 1930's. At that time heat pumps were primarily experimental and for the most part were economically impractical because of the relatively low cost of fossil fuels. During the last decade these economic factors have shifted to the place where heat pumps now appear to be on the threshhold of a broad mass expansion in use.

The adaptation of solar heating systems is currently hampered by the needs of large capital investments, the problems of the integration of the necessary solar collector designs into building architecture, and the relative abundance of fossil fuels which still exist on this continent.

In mild climates having low heating demands, solar energy is capable of supplying all of the heating needs.

One of the interesting near future possibilities for the utilization of solar energy for space heating appears to be in the adaptation of solar energy as a heat pump heat source, either partial or total, in order to permit the economic expansion of heat pumps to the more northerly states.

I proposed such systems in 1947. Later, J. L. Threlkeld and I developed complete analyses of solar energy heat pumps systems for small building application in four cities in the U. S., as reported in the ASHAE Journal Sections of the January and February 1954 HPAC's. A single stage compressor system forming a year 'round heat pump air conditioning system with evaporator side heat storage was assumed.

A hypothetical storage medium with a heat of fusion of 10,000 Btu per cu ft and a melting temperature of 50 F was selected to fix storage volume and evaporator temperature conditions. Several chemical manufacturers have indicated the possibilities of synthesizing such a material, although it is not currently available. Weather Bureau records over a period of 20 years were analyzed to determine the heat storage periods required. Design conditions and operating costs for this hypothetical solar source heat pump system are summarized in Table 2.

Amortization costs for the heating plants and the collectors were not included since the solar collector costs are changing so rapidly that any figures would most likely be inaccurate. Although amortization costs are an important factor, perhaps even more important is the fact that the installation of the heat pump permits cooling in the summer months and thereby provides total space conditioning in any season.

Develop Solar Equipment

One of the serious problems involved in the utilization of solar energy, either totally or partially, for space conditioning concerns the large capital costs required for the collection equipment. The energy is so diffusely spread that large area collectors are necessary. In the past the collector costs have been high not only because of the areas required but also because of the high cost of fabricating materials.

Traditionally, the bounding surfaces transparent to solar radiation have been of high quality glass, and the absorbing surfaces within the collector have been expensive to construct. Several technological breakthroughs, however, are now apparent. At least one plastic film has been developed which possesses desirable solar transmissivity characteristics and which should eventually be economical.

Processes for the roll bonding of plates of copper and aluminum have been developed which will reduce the cost of the absorber plate-collector tube combination.

Of even greater importance, however, may prove to be the work of H. Tabor, in Israel, who has developed surface treatments for both copper and aluminum which provide solar radiation absorption coefficients of approximately 0.9 and an emissivity of less than 0.10 for the energy re-radiated from the collector plate.

Developments such as these bring much closer the era of low cost solar energy collection for all purposes, especially space conditioning. ‡

TABLE 2—DESIGN CONDITIONS AND OPERATING COSTS for a hypothetical solar source heat pump system are summarized here for four U. S. cities

	Madison, Wis.	Lincoln, Neb.	Nashville, Tenn.	New Orleans, La.
Calculated design heat loss, Btu per hr	65,000	62,000	53,000	35,000
Capacity heat pump evaporator, tons	4.2	4.0	3.4	2.3
Flat plate solar collector area, sq ft	1210	715	1010	226
Emergency auxiliary heating system, Btu per hr	31,000	27,000	18,000	8200
Volumetric heat storage requirement, cu ft	600	460	470	156
Cost of fuel*:				
Electricity, cents per kwhr	1.5	1.6	0.4	2.0
Natural gas, cents per 1000 cu ft	90	50	75	55
Oil, cents per gal	14.2	11.5	13.8	12.0
Average winter heating cost, dollars				
Gas	162	72	65	15
Oil	199	135	98	27
Heat pump	94	78	19	20

*Based not upon initial rates but upon the rates attained after monthly average needs of energy for other purposes are first consumed.

Flexible Duct Units Supply Conditioned Air to Cars

. . . when not in use, shutoff dampers prevent waste

GOOD C
COMPLETE FOUNTAIN
CHICKEN

A Las Vegas drive-in restaurant provides parked cars with a constant supply of cool, clean dehumidified air, according to the Carrier Corp.

The system not only cools the car in summer but sends in warm air in winter.

Air is delivered to cars through a 6 in. rubberized flexible duct, terminating in a specially designed boot. The boot is inserted in the driver's window and held in place by a spring.

Controls on the outlet permit the driver to adjust the air conditioning. ‡

Arc Weld 21 Miles of Steel Pipe For New Skating Rink

. . . technique used because of wind conditions

MORE than 21 miles of steel pipe were field-fabricated by arc welding at the Mark C. Steinberg Memorial ice skating rink, nearing completion in Forest Park, St. Louis, according to the United States Steel Corp. The 230 ft long and 120 ft wide outdoor rink, costing over $800,000, will be one of the largest of its kind in the U. S.

Of 128,917 ft of steel pipe, 112,578 ft is 1¼ in. diam pipe which will carry the refrigerant to freeze the surface of the rink.

The steel pipe will be 1½ in. below the surface of a 5½ in. concrete slab. The pipe is parallel to the 120 ft length in 922 rows spaced at a little over 1 in. apart. The pipes on the north end of the rink are connected together by loops. The south end of each length is connected to a steel pipe header which measures from 6 to 14 in. in diameter.

Before the pipe was laid, the area was surfaced with tons of small rock and screenings and rolled with a pavement roller. The pipe is set on top of five gage wires resembling small chairs. The chairs are stapled to a wooden board which is nailed to leveling posts that have been driven into the ground to within ⅛ in. tolerance.

After the piping is installed and welded, the 30,000 sq ft area will be filled with concrete at one time. This monolithic slab will require from 500 to 600 cu yd of concrete.

When completed, the slab will be perfectly level, not varying more than ⅛ in.

About 16,000 gal of calcium chloride brine will be circulated throughout the piping at from zero to 10 F. Caustic soda is added to the brine to prevent an acid condition.

A frost will form on the chilled concrete. The rink will not be flooded, but water will be sprayed on the concrete surface by a fire hose with a fog nozzle. The spray will freeze instantly. The curb surrounding the rink is made in the form of a parapet so that excess water will not accumulate. The finished surface will be suitable not only for regular skating but will be sufficiently thick to allow ice hockey games.

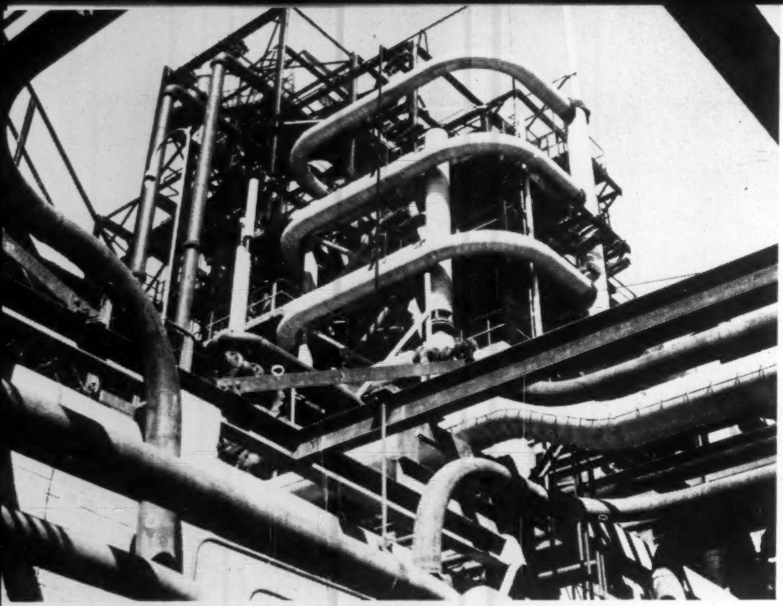
461 LOOPS were welded to 40 ft lengths of pipe. Procedure saved many man hours

The pipe coils were fabricated at the site. The pipes were supplied in exact lengths of 40 ft, 5¼ in. to save fabricating man hours.

The pipes were placed on a table made of bar stock. At the top of the horizontal frame inverted roller skate wheels were placed. The 40 ft lengths were then rolled on to the welding table and held in place between the roller skate wheels. Because of wind conditions, the usual gas welding technique was replaced by arc welders.

The welder was able to flex the pipe loop ends up naturally and make two continuous passes at once. The slag was washed away by the second pass and no chipping was required.

The brine will be centrally cooled in a centrifugal refrigeration unit similar to units used to air condition large buildings. ⌖



SINUOUS AND COMPLEX, refinery piping is but one of the many practical applications where computing machines are saving time and money

How Giant Brains Aid Piping Design

Flexibility problems that are too complex for human brains are being cracked quickly and economically by automatic digital computers. The author outlines typical current programs, describes briefly the equipment available, and explains his own program for machine calculation. Two previous articles were in the May and June HPAC's.

BY JOHN E. BROCK
Professor of Mechanical Engineering
U. S. Naval Postgraduate School

COMPUTERS in general — and how they may be instructed to perform simple sequences of operations — were discussed in the previous article in the June HPAC. This concluding article outlines an actual working program for piping flexibility analysis.

Our program, using the National Cash Register Co.'s general purpose electronic digital computer NCR-CRC 102A, is actually made up of five programs, designated by the letters *A*, *B*, *C*, *D*, and *E*. Each program is stored between uses on a deck of IBM cards, enabling the program to be read quickly into the computer main memory.

Program *A* will be described in some detail later, but first here are the other programs. Program *B* reads into the main memory of the computer information which has been prepared and stored on punched cards by Program *A*. For certain piping configurations, it is convenient to compute, in Program *A*, more information than actually will be used. This is the case especially for configurations having intermediate constraints which restrain some, but not all, of the six motion components that a point may have (three displacements and three rotations).

Program *B* is coded to reject the superfluous information and rearrange the useful information in a proper format. Then it changes the magnitudes from "absolute" to "floating point" form. This necessity is implied by the fact that the numbers with which the computer is able to operate can never become greater than +1 nor less than −1.

Floating Point Arithmetic Eliminates Scaling

Accordingly, in starting to process the problem, appropriate scale factors must be used to assure that during the computation no numbers greater than unity are generated. However, when it comes to solving the set of simultaneous linear equations ultimately involved, the answers are not known ahead of time. If things were scaled down so small that there would be no chance of generating an "overflow" — that is, a result larger than unity — most of the accuracy would be lost.

So floating point arithmetic is used, in which a number is represented by two separate parts, much in the same way that the logarithm of a number represents the number and consists of two parts, a mantissa and a characteristic. Briefly, floating point arithmetic has the advantage of eliminating the necessity of scaling and assures that overflows cannot occur; and it has the disadvantages of requiring much more complicated coding and being much slower in operation. For example, with

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The author is a member of HPAC's board of consulting and contributing editors and has written several articles published in HPAC on the subject of piping design.

absolute arithmetic, addition requires only one command and is executed in about 0.008 seconds; with floating point arithmetic, 22 commands are required and the operation takes about 0.350 seconds.

After selecting and rejecting data, reading in, rearranging, and converting from absolute to floating point form, the *B* program makes a matrix row sum, for subsequent checking purposes, and stores the processed information on the magnetic tape so that it can readily be referred to by the *C* program, which actually solves the simultaneous equations and checks the solution.

This *C* program uses the "square root" method, a type of Gauss-Doolittle pivotal elimination method, which affords a very rapid solution and uses a minimum of storage. We have used the program to solve a piping system involving 41-fold redundancy.

The present coding has an undesirable feature. Designed to treat "big" problems, it is unwieldly for "small" problems, and spends a lot of time writing information on the magnetic tape and reading from the tape in cases where there is actually adequate space in the main memory to do the computing and store the results. Even so, it requires only 8 minutes to solve eight equations, including checking both the forward and the back solutions.

The *D* program now accepts the results of the *C* program — the solutions for the redundant force and moment components — and changes them back from floating point to absolute form to speed up subsequent operations, incorporates the actual flexural rigidity, *EI* (up to this point only relative values are used), determines the six force and moment components and the resultant force and moment at any point of the configuration, and finally prints this information in useful decimal form.

Program *E*, which still requires some polishing up before it can be regarded as completed, computes deflections at any point of the configuration. The trouble with Program *E* in its present form is that it requires too much individual coding for each particular problem. A good Program *E* should be able to accommodate any piping problem with considerably less special treatment. Such a program is being evolved.

A's Subprograms Split Into Three Groups

Now let's take a closer look at Program *A*. The reader who knows something about the "matrix" method of piping flexibility analysis will see more clearly why things are done as they are. But any reader will get a general idea of what is involved. The 20 subprograms may be divided into three groups as follows:

- *Group* 1. *Information Input and Output*

Main memory to IBM cards, *A*-1, *A*-2.
IBM cards to main memory, *A*-3, *A*-4.
Main memory to Flexowriter, *A*-12.
Flexowriter to main memory, *A*-14.
Main memory to magnetic tape, *A*-15.
Magnetic tape to main memory *A*-16.

- *Group* 2. *Matrix Operations*

Clear one matrix space in memory, *A*-6.
Add matrices, *A*-7, *A*-18.
Transpose matrix, *A*-9.
Shift matrix from one location to another, *A*-10.
Star-multiply matrices, *A*-11.
Compare two matrices, element for element, *A*-20.

- *Group* 3. *Formation of Basic Matrices*

Form flex-matrix for 90 deg bend or elbow, *A*-5.
Form transfer matrix, *A*-8.
Form flex-matrix for straight element, *A*-13.
Form "gamma" matrix for branched system, *A*-17.
Form column matrix of terminal movements, *A*-19.

The matrices with which we deal are arrays consisting of 36 numbers arranged in a square of six rows and six columns. Each matrix has a "code" or identifying number which instantly distinguishes it from any other matrix. The matrix is formed by one or more of the processes in Groups 2 and 3, in a certain group of cells in the main memory.

This group of cells may be thought of as a square array of eight rows and eight columns, if we think of these cells as being numbered *xy*00, *xy*01, *xy*02, *xy*03, *xy*04, *xy*05, *xy*06, and *xy*07, in the first row; *xy*10 through *xy*17 in the second row, and so on. The code number goes in cell *xy*00 and the rest of the first column and first row remain blank.

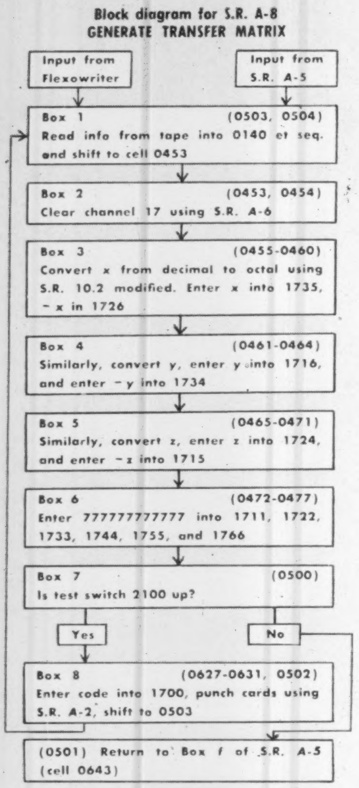
The 36 matrix elements occupy cells *xy*11 through *xy*16 in the second row, *xy*21 through *xy*26 in the second row, and so on. The last row and the last column may remain blank or may be used for automatic checking of arithmetic operations.

Now each IBM card is able to store four words, so that we use two cards to store one matrix column in the following way. The first word of the first card is the "augmented code;" that is, the matrix code number to which has been appended the number of the column. Thus, if the matrix code is 560 and we are dealing with the third column, the augmented code is 563.

The last three words of the first card and the first three words of the second card are the six elements of the matrix column. The last word of the second card is the augmented code again, so that each card will contain a description of the numerical information it contains.

Now let us see how programs *A*-1 and *A*-2 are used. Each is a subroutine, which means that it can be used any place in a program, starting out by shifting command to the subroutine and returning command, after finishing the process, to that part of the main program from which it had jumped.

If we want to punch IBM cards containing column *j* of the matrix stored in cells *xy*00 to *xy*77, we see to it that our program writes the number *xy*0*j* into cell 0160 and jumps command to cell 0030. Immediately, the IBM card punch will groan twice, emitting the two cards which contain the matrix column desired and will return to the main program at the place immediately after the command which sent it to cell 0030.


Block diagram for S.R. A-8
GENERATE TRANSFER MATRIX
Input from Flexowriter
Input from S.R. A-5
Box 1 (0503, 0504)
Read info from tape into 0140 et seq. and shift to cell 0453
Box 2 (0453, 0454)
Clear channel 17 using S.R. A-6
Box 3 (0455-0460)
Convert x from decimal to octal using S.R. 10.2 modified. Enter x into 1735, − x in 1726
Box 4 (0461-0464)
Similarly, convert y, enter y into 1716, and enter − y into 1734
Box 5 (0465-0471)
Similarly, convert z, enter z into 1724, and enter − z into 1715
Box 6 (0472-0477)
Enter 777777777777 into 1711, 1722, 1733, 1744, 1755, and 1766
Box 7 (0500)
Is test switch 2100 up?
Yes
No
Box 8 (0627-0631, 0502)
Enter code into 1700, punch cards using S.R. A-2, shift to 0503
(0501) Return to Box f of S.R. A-5 (cell 0643)

2 BASIC LAYOUT of author's computing program shows typical operations. Most of the commands are shared by Programs A-8 and A-5 since in the latter program transfer matrices are used incidentally but their contents need not be saved

Program *A*-2 punches out 12 cards containing an entire matrix. If the desired matrix is stored in cells *xy*00 to *xy*77, the main program must put the number *xy* into cell 0027 and shift command to cell 0060. Then Program *A*-2 uses Program *A*-1 six times, punching out successive pairs of IBM cards containing successive columns of the matrix, each identified by its augmented code.

Programs *A*-3 and *A*-4 do just the opposite, reading six pairs of IBM cards into the main memory so as to store an entire matrix in a selected sequence of cells. These programs have the additional feature that if the two cards of a pair do not have identical codes, including the augmented digit, the program will print a warning and stop.

Program *A*-15 assigns a code to a matrix in a selected portion of the main memory and transfers everything to a selected portion of the magnetic tape, and Program *A*-17 does just the opposite.

Program *A*-12 permits one to fill an entire matrix in decimal rather than octal numbers, using the Flexowriter, putting the results into a selected portion of the main memory, and then causing the computer to convert all the matrix elements — but not the code — from decimal to octal so that it can be used for subsequent computations. This program is useful for inserting flexibility data for special piping elements where it is easier to compute the information manually than it is to devise special programming to do it automatically.

Program *A*-14 is essentially the inverse of *A*-12. It prints out the elements of a selected matrix in the main memory, first converting the element from octal to decimal so that it will have immediate meaning to the operator, and prints the elements in the proper square arrangement. This program is most useful for checking purposes and debugging.

The Group 2 operations are mostly self explanatory. *A*-6 fills zeros into all the cells corresponding to a matrix and is used preparatory to the generation of a matrix by Programs *A*-5, *A*-8, or *A*-13. There are two "add matrices" programs, one reading addends from IBM cards and storing results on IBM cards and the other making use of the magnetic tape. For the most part, the two programs overlap, that is they use the same commands in the same cells; but by use of "test switches" they may be made to branch from one another at appropriate places to refer to and activate the proper programs from Group 1.

Star-multiply matrices is a term coined for the present purpose. The product A^*B means postmultiply matrix *A* by the transposed of matrix *B*. Ordinary matrix multiplication is accomplished by using both Program *A*-11 and Program *A*-9. Program *A*-20 is used for checking and debugging purposes.

The Group 3 operations refer specifically to matrices which are involved in the theory of the matrix method of piping flexibility analysis.

Subprogram Explained in Detail

Program *A*-8 will be explained in some detail to illustrate one subprogram completely. It is simple enough that we will not become lost in detail.

The transfer matrices are the *B*-matrices of the matrix method and consist of an array of zeros, units, and coordinates of the point to which they refer. In determining a transfer matrix using Program *A*-8, the input data comes on paper tape in the form of sequences like: matrix code, tab, *d*, *x* coordinate, tab, *y* coordinate, tab, *z* coordinate, tab, *o*, *s*, *x*.

When the main program starts the tape read operation, data is filled into the main memory, the desired code — octal — going into cell 0140. The *d* signals that the subsequent data is decimal so that the *x*, *y*, and *z* coordinates of the point in question are filled decimally into cells 0141, 0142, and 0143. Then the *o* signals the machine that subsequent fills are octal rather than decimal. The *s* starts computation in cell 0453 and the *x* stops the paper tape until another 11 command in the main program starts it up again.

The program fills zeros into cells 1700 to 1777 inclusive, converts the *x*, *y*, and *z*, coordinates to octal, putting the converted *x* into 1735 and its negative into 1726, *y* into 1716 and −*y* into 1734, *z* into 1724, and −*z* into 1715, and 777777777777 into cells 1711, 1722, 1733, 1711, 1755, and 1766. Then it transfers the code number from cell 0140 into cell 1700, and finally, using *A*-1 and *A*-2, it punches out the 12 IBM cards which store the matrix which it developed in 1700 through 1777. The octal number 777777777777 appearing above is as close as we can get to unity; it represents the number $1 - (\frac{1}{2})^{36}$ which differs from unity by less than 1 part in 68 billion! This is a tolerable error.

The basic layout of this program is shown by the block diagram in Fig. 2. Most of the commands are shared by Program *A*-8 and *A*-5 since in the latter program transfer matrices are used incidentally but their contents need not be saved. If test switch No. 2100 is down, it is Program *A*-5 which is being used, and after computing the transfer matrix the command is shifted back to *A*-5 for subsequent operations. If this switch is up, the *A*-8 program continues and actually punches out the results on IBM cards, returning to the start of the program to compute another transfer matrix. When all such matrices have been computed, command may be taken from the *A*-8 program and shifted elsewhere simply by punching the proper information in the paper tape which is read by the commands in Box 1.

The *A*-13 program treats only those straight piping elements which are oriented parallel to one of the coordinate axes; this includes 90 percent of straight elements occurring in actual systems. Those straight elements which have general orientations can be handled by using part of *A*-5 along with the programs in Group 2. Of course it is necessary to compute the direction cosines which describe the orientation of the pipe from the geometry of the layout. In our present coding, these direction cosines are computed manually.

Program *A*-5 computes flexibility matrices for 90 deg elbows and bends the terminal tangents which are parallel to coordinate axes. More general orientations are easily accommodated by determining the direction cosines describing the orientation. For bends other than 90 or 180 deg, it is necessary at present to compute some basic constants manually and complete the computation by entering into the middle of *A*-5.

The generation of column matrices for terminal movements involves only obvious arithmetic and the "gamma" matrices will not be discussed further than to say that they are obtained by matrix multiplication operations involving two transfer matrices and one flexibility matrix sum and are useful in treating multiply branched systems. In effect, they represent the deflections experienced at one point of a complex system as a result of forces and moments applied to another point.

Machine Quits If Errors Occur

How does this whole program work? Very well, but not entirely without difficulty. In the first place, the machines do make errors. There is a finite probability that any of the several thousand elements and components which go to make up the apparatus will fail during the next second. Just one failure in 10 million arithmetic operations can lead to the wrong answer.

If failures occur, the machine soon decides it's time to quit and does so. Then maintenance personnel track down the difficulty and restore the machine to service. However, it does happen that the machine can make an isolated arithmetic error without giving warning. The machine with which we work has done this twice in the last two years. But most of the errors are "cockpit" errors.

Several internal checks in our program discover inconsistencies in input data. But it is still possible through inadvertence to assign the machine the task of solving a system which may be realizable in practice but which is not the one at hand to be treated. Thinking in terms that the machine understands is a discipline that is foreign to the human mind, so that the usual error is simply to omit some little detail like a tab or a slash. Then, as the machine chews on the data, it comes to the place where the tab or the slash should have been and instead of doing as one would want, it goes down the wrong track for a while until things are so snarled up that the machine decides to quit with an "error-print," signifying an overflow or an improperly modified command. In this case, the operator has to go back over the record of input and operations until he finds the error, after which the machine may be restarted, back on the track.

Because the problems posed to the machine involve less idealization than those customarily attempted manually, there is generally a greater volume of input data to be handled. A great deal of effort and close attention is involved in reducing this data and putting it on paper tape or in some other form such that the machine can accept it. Since each problem differs in some fundamental way from previous problems — otherwise there would be no point in taking it under attack — there are intermediate steps to be coded and followed carefully.

Actually, following the sequence of a problem involves at present shifting decks of punched cards from one machine to another at appropriate intervals, switching test switches from one position to another, activating the magnetic tape at the proper time, and so forth.

Finally, one step which cannot be assigned to the machine is the final, pay-off step, in which the piping engineer looks over the final results, decides whether the results are reasonable answers to the given problem, and, on the basis of the results, the pressure piping code rules, and his own experience, decides either that the given configuration is satisfactory as it is or is not satisfactory. In the latter case, he must suggest appropriate modifications.

Notwithstanding the difficulties which still surround it, in our opinion, there is no question but that automatic digital computation of piping flexibility problems is the quickest, most economical, most certain, and generally most satisfactory way of treating these problems. We are sure to see an increasing use of machine solution to these and similar difficult engineering problems. ╪

The author gratefully acknowledges the material assistance he has received during and following the programming work described in this article, from Midwest Piping Co., Inc., in particular, from Mr. E. A. Kerbey, president, and Mr. W. A. Palm, vice president, of the company.

As more glass cube office buildings join New York's skyline . . .

How Are They All Air Conditioned?

- **most perimeter systems use induction units or fan-coil units**
- **multiple or central fan rooms serve interior systems**
- **trend is seen to prefab round ducts joined by special couplings**
- **single or double duct choice follows pattern of occupancy type**
- **much equipment is being installed on roofs**

BY LEWIS SMITH
Heating Engineer

NEW OFFICE BUILDINGS have been going up in metropolitan New York at a swift steady rate since World War II. One authority has it that more office buildings have been erected in Manhattan alone than in all the rest of the country put together, and that the added space has been greater than all the office space in the entire Chicago Loop area.

How are these new buildings air conditioned? How do they differ in basic type of system or in certain features? What is the current trend in methods and how will it affect the future? A recent survey of a group of typical buildings reveals some interesting answers to these questions and brings to light significant opinions of several leading consulting engineers.

For this survey commercial buildings were selected rather than home office buildings occupied exclusively by one company. Owner occupied buildings are usually built for special occupancy requiring specially designed air conditioning systems to suit a single occupant. Such buildings are not erected primarily to make a profit as are strictly commercial buildings.

Of commercial buildings there are two classes:

1) Buildings financed by companies not directly engaged in the building business, to accommodate their own offices but with the major portion of the space rented to others. Such buildings are not designed purely for profit, although the investment is expected to pay its way.

2) Buildings erected by companies engaged in the building business seeking to make the maximum profit.

There is a difference in the attitude of these two classes of builders which is expressed in the building design. A company erecting a building which will bear its name has a certain regard for its own prestige that may result in a more expensive tailor made air conditioning system than the owner of a purely profit making building can afford. This prestige may result in somewhat higher rentals.

In the following, the division between what is meant by exterior and interior spaces is a line about 20 ft in from the outside wall.

Two Main Types of Perimeter Systems Used

For perimeter air conditioning two types of systems are mainly being installed today: the induction unit system and the fan-coil unit system.

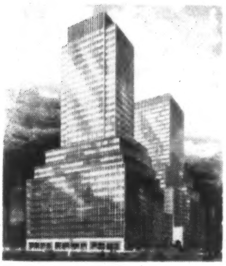
By induction is meant a copper finned element supplied with water (hot or cold) and air (warm or cold) supplied from vertical high velocity risers (usually circular) passing through nozzles in the unit to induce circulation of room air.

By fan-coil unit is meant a copper finned element supplied with water (hot or cold) and equipped with a motor driven fan to blow room air through the element.

Induction units may not require condensate drip lines, but fan-coil units always do. Obviously, electric connections are needed for fan-coil units but not for the induction type units.

A few years ago it looked as if the fan-coil units were preferred, especially in strictly commercial buildings.

. . . fan-coil units serve these typical buildings



485 LEXINGTON AVENUE

(rear building)

30 stories, occupying block from 46th to 47th Streets

BUILDER AND OWNER:
Uris Bros.
ARCHITECT:
Emery Roth and Sons
CONSULTING ENGINEER:
Henry B. Oehrig
AIR CONDITIONING CONTRACTOR:
Raisler Corp.

Installed in the basement is 2200 tons of refrigeration, consisting of two 1100 ton centrifugal compressors driven by steam turbines using steam supplied at 125 psig from street mains.

Perimeter zones are conditioned by about 1700 fan-coil units, with fan speed switches for individual control. In addition the piping is arranged for separate control of each of the four exposures and split in the middle of the building to provide upper and lower zones. With steam available during the summer, supply headers for each zone are so arranged that chilled water and hot water from heat exchangers may be mixed by manual setting of valves to maintain any desired temperature of water. Thermometers enable the building engineer to observe conditions at all times.

Interior zones are served by low velocity rectangular sheet metal ducts, with three fan rooms per floor up to the fifth floor, two such rooms per floor up to the 20th, and four fans in one room for the tower. Changes in air conditioning requirements to suit tenants can be made locally instead of affecting the entire interior system.

800 SECOND AVENUE

18 stories, occupying block from 42nd to 43rd Streets and about 80 ft deep

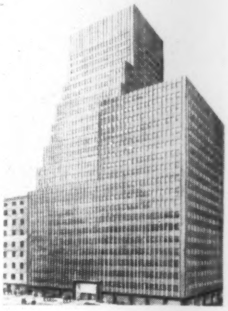
BUILDER AND OWNER:
H.R.H. Construction Corp.
ARCHITECT:
Pomerance and Breines
CONSULTING ENGINEERS:
Seelye, Stevenson, Value & Knecht
AIR CONDITIONING CONTRACTOR:
Raisler Corp.

This building, a typical office building of moderate height and size in a good location, was designed from a purely commercial point of view.

Centrifugal compressors driven by steam turbine in the basement, with 125 psig steam from street mains, provide 870 tons of refrigeration.

Perimeter zones are conditioned by about 1000 fan-coil units two per bay, with individual control by fan speed switches.

The interior system has 18 fan rooms, each of which serves half of two floors. For example, the room on the fifth floor serves the north halves of the fifth and sixth floors, while the room on the sixth floor serves the south halves of the fifth and sixth floors. Thus, zoning is achieved by means of a single fan unit on each floor. All rooms are so located that outside air is brought in from an intake on each floor without the need for a central shaft. All units have low pressure steam preheater coils, and steam reheaters are used as required for tenants. All fans are sized for eight air changes per hr.



110-120 WILLIAM STREET

31 stories, corner William and John Streets

BUILDER:
John-Platt Realty Corp.
ARCHITECT:
Sylvan Bien, Robert L. Bien
CONSULTING ENGINEER:
Sears & Kopf
AIR CONDITIONING CONTRACTOR:
Kerby Saunders, Inc.

Two steam turbine driven centrifugal compressors in the basement use 125 psig steam from street mains to produce 2200 tons of refrigeration. Perimeter air conditioning is by about 1500 fan-coil units. Manual control is provided by speed switches, but pneumatic risers are to be installed for connection to thermostatic control of units when and if installed by the tenant.

Interior zones are served by fan rooms in the subcellar and on the 11th, 12th, 21st, 30th, and 31st floors. Location of these rooms was in part dictated by provision for incorporating into the new structure an existing 20 story building and in one case providing passage through to an adjoining building. Rectangular sheet metal ducts are used throughout with a maximum fan static pressure of 3 in. WG. Each floor will have two distribution zones, each with steam reheaters thermostatically controlled.

Outside air supply to the fans in the subcellar is through a continuous grille above the store windows on the ground floor on the William Street side, and the exhaust is through a similar grille on the John St. side. The new building is reinforced concrete. The existing 20 story building will be stripped down to the frame and floor slabs and then incorporated into the new building.

But the trend now seems to be toward induction units. Fan-coil units are said to be cheaper to install, especially in buildings having large glass areas, and of course first cost is vital in commercial buildings. The lower cost is due in part to the elimination of the conduits and the high pressure fans and also to being able to crowd more capacity into these units, thus reducing the number.

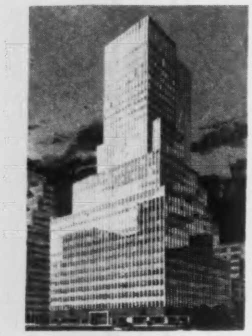
Thermostatic control of the induction units is somewhat cheaper since control of multiple fan speeds is not involved, but some builders like the three or four speeds available with fan-coil units as a means for providing individual fingertip control by positioning the speed switch.

Fan-coil units are liable to be noisier, and the fans must be operated in winter to provide heat. From the maintenance angle, the servicing of so many fans and motors in occupied spaces in a large building may be a problem reacting in favor of induction units.

Filtering is a problem in either case, but all fan-coil units used in office buildings do not have outside air inlets at each unit. In this respect, the induction unit has an advantage in supplying outside air to the perimeter spaces, while air usually must be supplied by the interior system when fan-coil units are used.

Whichever type is used, the units themselves are almost always set in semirecesses under the windows and

. . . induction units are installed in these



425 PARK AVENUE

31 stories, at 55th Street. Called the Nabisco building, as the National Biscuit Co. will occupy five floors

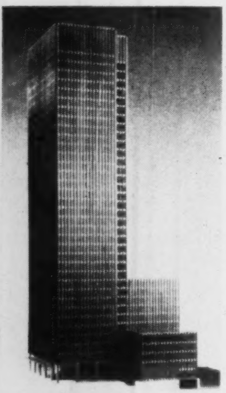
ARCHITECT:
Kahn & Jacobs
CONSULTING ENGINEER:
Slocum & Fuller
GENERAL CONTRACTOR:
Geo. A. Fuller
AIR CONDITIONING CONTRACTOR:
Almirall & Co.

Refrigeration equipment totaling 1650 tons of air conditioning capacity is installed on the roof. One 550 ton steam turbine driven centrifugal compressor receives 125 psig steam from street mains and exhausts steam at 13 psig into two absorption units, each rated at 550 tons.

Perimeter conditioned air is distributed by a high velocity conduit system, with about 2000 induction units under the windows. Pneumatic air piping is installed for future thermostatic control of units.

The interior system is served by a fan room in the basement supplying air up to the 12th floor and a fan room on the 23rd floor supplying air to the 13th to 31st floors. Static pressure at fan outlets is up to 8 in. WG.

Dual duct risers supply air at from 58 to 68 F via the cold duct and up to 140 F via the hot duct. The capacity of the hot duct is 15 percent of the cold duct. At each floor the branches are connected through a novel mixing valve operated from a return air thermostat. This valve is said to be capable of handling up to 9000 cfm in a casing 2 ft in diameter by 2 ft high. Riser ducts are of prefabricated sheet steel up to 50 in. diameter. Interior systems are arranged for one zone per floor except on the lower floors, where there are two zones.



375 PARK AVENUE

38 stories, from 52nd to 53rd Streets

OWNER:
Seagram Distillers Corp.
ARCHITECT:
Mies van der Rohe and Philip Johnson
ASSOCIATE ARCHITECT:
Kahn and Jacobs
GENERAL CONTRACTOR:
George A. Fuller Co.
CONSULTING ENGINEERS:
Jaros, Baum & Bolles
AIR CONDITIONING CONTRACTOR:
Kerby Saunders, Inc.

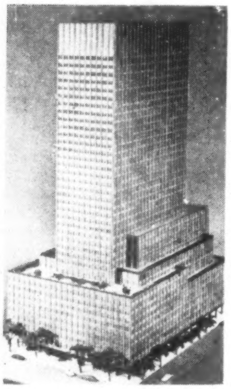
Owner will occupy about one-third of the space, the rest to be rented by other firms.

Two steam turbine driven certrifugal compressors providing 3200 tons of air conditioning capacity are installed on the roof. They use steam at 125 psig from street mains.

Perimeter conditioned air is distributed by high velocity conduit system supplying 3624 induction units under the windows. Water piping is in two vertical zones and is also split into four zones for exposure. Pneumatic temperature control is provided for all induction units.

The air conduits installed in interior shafts have branches in the hung ceilings to supply the induction units in each bay. Because of extremely low sill heights, the induction units are only 12 in. high but are still kept within a depth of 10 in. Water piping is boxed inside the columns, the concrete fireproofing being formed to the shape of the steel beam.

There are two fan rooms, one in the second subbasement and the other on the roof. Air conditioning supply for the interior zones feeds into dual risers which are circular, up to 44 in. in diameter, made of sheet steel, prefabricated in sections and assembled on the job with special couplings. The shafts containing these risers are used as plenum chambers for the return air. Static pressures developed by the fans may be up to 9 in. WG. Distribution on each floor may be by single ducts with mixing dampers at the connection to the dual risers or the dual ducts may be extended in the hung ceiling with mixing dampers at each outlet or each group of outlets, according to tenant requirements. All ducts in hung ceilings are insulated because of heat from lighting, which in the exterior office spaces is in the form of luminous ceilings.



666 FIFTH AVENUE

39 stories, from 52nd to 53rd Streets, adjoining Rockefeller Center

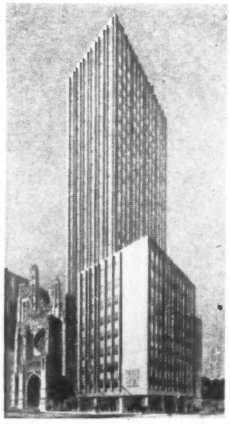
BUILDER AND OWNER:
Tishman Realty & Construction Co.
ARCHITECT:
Carson & Lundin
CONSULTING ENGINEER:
Cosentini Associates
AIR CONDITIONING CONTRACTOR:
Raisler Corp.

Refrigeration equipment totaling 3400 tons of air conditioning capacity, includes two steam turbine driven centrifugal compressors on the roof supplied with 125 psig steam from street mains and one 400 ton unit in the basement.

Perimeter air conditioning is by conduit system with induction units equipped with pneumatic temperature control.

The interior system has one fan room on the 10th floor supplying the second to 14th floors and another on the roof supplying the 15th to top floors. The ground floor and basements are on a separate system. There are four zones on each floor.

The engineers made a comprehensive analysis of all possible ways to air condition these spaces and their answer was a compromise between high and low velocity by which the static pressures are limited to about 2 in. WG, permitting the use of rectangular ducts without special bracing or welding, but at the same time avoiding the use of ducts of execessive size.



CANADA HOUSE

27 stories, Fifth Avenue at 54th Street

ARCHITECT:
Eggers and Higgins
CONSULTING ENGINEER:
Syska and Hennessy, Inc.
GENERAL CONTRACTOR:
Walsh Construction Co.
AIR CONDITIONING CONTRACTOR:
Alvord and Swift

One motor driven centrifugal compressor totaling 600 tons of air conditioning capacity is installed in the subbasement.

Perimeter zones with induction units under the windows receive

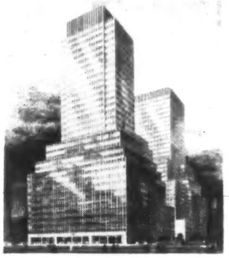
new structures

conditioned air through a high velocity conduit system.

Serving the interior zones are single low velocity rectangular sheet metal ducts which supply conditioned air at 1500 to 1800 from fan rooms in the subbasement and on the 27th floor. Static pressures at the fans range from 2½ to 3 in. WG for interior systems and from 7½ to 8 in. WG for the exterior systems. Air distribution on each floor is by rectangular sheet metal ducts in hung ceilings, sized for 1000 to 1200 fpm velocity. Return air is taken from each floor by means of a single riser duct to the fan rooms.

Due to its shape, this building has relatively small interior areas. Therefore, the majority of the air conditioning load is satisfied by the perimeter induction units, which are controlled in groups from room thermostats operating modulating valves in the water line to each group.

First cost determined to some extent the type of air conditioning systems provided. It was this factor, for instance, which led to the selection of electric motor drive rather than steam turbine in spite of the availability of street steam. In conjunction with the shape of the building and the preponderance of exterior office areas this cost factor also justified the elimination of such things as re-heater coils, thus permitting the simplification of controls.



750 THIRD AVENUE

34 stories, occupying the block from
46th to 47th Streets
BUILDER AND OWNER:
Uris Bros.
ARCHITECT:
Emery Roth & Sons
CONSULTING ENGINEER:
Henry B. Oehrig
AIR CONDITIONING CONTRACTOR:
Raisler Corp.

Providing 2175 tons of air conditioning capacity, centrifugal compressors in the basement are driven by steam turbines supplied with 125 psig steam from street mains. In the case of this building and the 485 Lexington Avenue building, floor space at the top of the building was considered of much greater value than equal space in the basement. Building setbacks required by code limit the area on the top floors.

Perimeter zone air conditioning utilizes about 1700 induction units with high pressure conduits on the exterior walls alongside the columns. Individual temperature control is provided by room thermostats operating modulating valves on the water supply to each unit.

Interior zones receive conditioned air from fan rooms on the sixth, 11th, and 20th floors and the roof. The sixth floor room has a high pressure fan for the induction units and two low pressure fans for interior ducts from the second to the sixth floors. This is repeated in the 11th floor fan room, serving the seventh to the 16th floors. The fan room on the 20th floor is for the interior system only. The fan room on the roof supplies the high pressure conduits for the induction units down to the 17th floor. Vertical shafts are finished and serve as return air ducts.

then closed in by a front panel having inlet grilles, the outlets being in the window stools.

One objection sometimes raised to the induction unit is that with the windows continuous from column to column, there is no space to run the risers without interfering with the windows. Pipes can be furred in alongside the web of the column without protrusion, but this cannot be done with the much larger air conduits. One consulting engineer got around this by placing these conduits in the hung ceilings connected to risers in the main shafts in the interior space.

Interior Systems Show Great Differences

A far greater divergence of opinion and design occurs with the interior systems. Previously, a fan room with coils was placed on every floor, sometimes two to a floor, and at other times on every third floor, with low velocity rectangular ducts installed in the ceilings. To reduce costs, simplify installation and maintenance, and avoid the use of rentable space, these fan rooms were often placed in two locations: in the basement to supply the lower half of the building, and on the roof or an upper floor to supply the top half. This meant the use of pressures as high as 9 in. water gage and ducts or risers which, if rectangular, had to be braced and made air tight by the use of special joints. This naturally promoted the extensive use of welding.

More recently, however, the trend is toward the use of prefabricated circular steel ducts, assembled in sections at the shop and joined together on the job with special couplings. Round ducts up to 50 in. in diameter are now being used.

Nevertheless, multiple fan rooms are still being installed in some buildings. One 34 story building has nine such rooms, and another 30 story building has two to three rooms per floor. These are for low pressure systems, of course.

One consulting engineer reasons that when a building is in the design stage the tenants are often unknown. Suppose after the required cooling capacity has been estimated a tenant rents a floor. If a tenant has a lot of electrical equipment or a heavy lighting load, a change might have to be made in the expensive and rather special fans in the central fan room. But with fan rooms on each floor, probably only one fan of the ordinary type is affected and may easily be changed. Worse still would be such a change after the fan installation had been completed. This engineer therefore favors the individual fan rooms. And in a recent installation he was able to find space for them without much encroachment on the rentable area, compared with the space taken by the large air ducts.

In still another case of a 39 story building, it was possible to have fans on only the 10th floor and roof and yet keep the velocity and static pressure low enough to avoid expensive fans and ducts but high enough to avoid ducts of excessive size. This was in part accomplished by splitting the air distribution into four zones.

Another divergence in practice is the matter of single or dual ducts when central fan rooms are used. With the single duct system, reheaters — usually steam — are generally placed in the branch ducts on each floor, controlled by thermostats in the return air. Each floor can be split into several zones, of course. This is no doubt the cheaper way, but it is not as flexible as dual ducts. The control is in one direction: adding heat.

With dual ducts, two risers are used, one hot, the other cold air. The reduced duct dimensions favor high velocity, but mixing dampers or valves are required at each floor or each branch on a floor. By extending the dual ducts in the hung ceiling on each floor and using a mixing damper at each outlet or each group of outlets, the ultimate in temperature control can be provided. The control is in both directions — adding heat or cooling — and humidity is more accurately controlled.

Here again the type of building is apt to be the deciding factor. The owner occupied building is likely to have the dual duct system, whereas the purely commercial building tends toward single ducts with reheaters (and sometimes without reheaters to cut down the cost).

Many Refrigeration Plants Installed on Roof

All of the buildings surveyed purchase steam, thus eliminating boiler plants. That may have been a factor influencing the placing of the refrigeration equipment in most cases on the roof, leaving the basements almost devoid of machinery and adding a considerable amount of rentable space, space which due to air conditioning can be fully occupied at a good price.

Whether boiler plants would also have gone up to the roof was not a question because of the purchased steam. One difficulty relates to the storage of fuel. Where gas is used, no problem exists, but with oil there would no doubt be objection by the fire department and insurance people unless some means could be devised to avoid storage of oil on the roof.

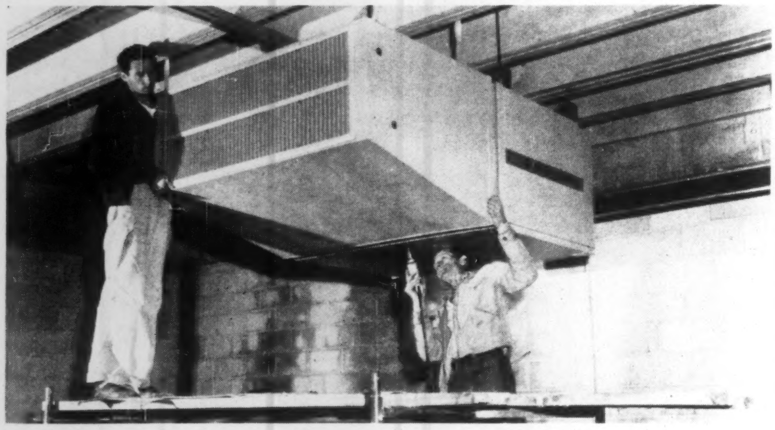
Cost studies made by consulting engineers indicate that placing the refrigeration plant on the roof of a skyscraper adds little if anything to the total building cost. That may not be the whole story, however. One architect pointed out that with some buildings the codes governing setbacks make upper floors diminish in area almost to the "vanishing point," as he expressed it, and this little area is mostly needed for cooling tower and elevator mechinery. To place the refrigeration plant up there too might mean the loss of a whole floor at a much higher rent than the equivalent basement area. The amount of rock excavation may also be a determining factor. ‡

Photo on p. 120 courtesy Carrier Corp.

ON THE JOB

Horizontal Units Condition New Dallas Mart

. . . biggest application of its kind



INSTALLED in the early stages of construction, package air conditioning units are suspended from the ceilings of the two story building

THE LARGEST single application of horizontal air conditioning units in the world is being installed in the new $6½ million Dallas Homefurnishing Mart, according to the General Electric Co. The package units, which both heat and cool the entire 434,000 sq ft of floor space, are suspended from the preformed concrete ceilings of the two story structure.

Each display and sales area leased to national manufacturers will have its own package unit individually controlled and metered. No ductwork was required in the installation of these horizontal units. Outside air is supplied from the roof of the building and blown through chases which also serve to conceal piping that leads to the unit.

A special air diffuser was designed for the units permitting the maximum supply of air to the deep display areas.

Totaling 600 tons in air conditioning capacity are 7½, 5, and 3 ton units. The 105 package units discharge air toward the inside walls instead of the usual outside, hotter walls. ‡

Sam
Lewis'
Page

Confessions of a Consulting Engineer

. . . some heating, piping, and air conditioning design bloopers which the author would avoid if he were to do the jobs over again

EVALUATING any heating, piping, and air conditioning installation requires looking at the bad as well as the good. In my experience I have had a number of occasions to consider what I would do differently if I were to design a project over again.

- A complete air conditioning plant had an adequate ventilating and cooling system serving the basement and the first and second stories of a store building.

The desirable differential temperature control between the first and second stories was met by having about half of the heat removal on each story absorbed by packaged air conditioning units.

The basement, only about half of which was in use, received no direct solar heat. By all calculations the basement should be satisfied with air at the same temperature and adjustable volume as that for the first story, with this air coming from the central ventilating plant. The basement was comfortable for the first summer only.

The owner then, finding the basement so comfortable and attractive, proceeded to more than double the illumination, and changed the former basement storage area to sales space. This attracted many more people to the basement.

As a result, when the entering air was cooled sufficiently to serve the basement, the first story became too cool, even while the auxiliary recirculating units — intended to balance the greater cooling demand of the first story — were shut down. It was not practicable to reduce or to adjust continually the volume of air going to the first story.

There were many days and evenings when no cooling whatever was needed for this store, except in the basement. As a result, the basement now has acquired an independently controlled cooling system.

Had I used the same common sense I really had at the time of the original design (because I did use it on contemporary plants), I would have made arrangements permitting delivery of air to any room or department at any reasonable range, warmer or cooler than the average, regardless of the temperature of the air being sent at that time to other departments.

- In another air conditioned store, happily not designed by myself, complaint was made to me that, while the occupants were comfortably cool, the place did not broadcast a pleasant odor.

Upon investigation I found that the offices did not smell encouragingly. The plans indicated an adequate outside air intake and adequate convectors for cooling and dehumidifying a mixture of at least one-third outside air, with two-thirds recirculated air.

However, while the plans showed an adequate exhaust fan, this fan had never been installed. Apparently the contractor concluded that he had given his money's worth before he reached this part of the job.

Both side walls of the building were party walls without any windows. The front end of the store had one double door with automatic closers and no windows. The back of the store had one door, necessarily kept locked, and no windows in communication with the air conditioned spaces.

Even though the outside air intake dampers were opened wide, no measurable amount of new air would enter, because the building already was full of air which could not escape. We compelled them to install the exhaust system.

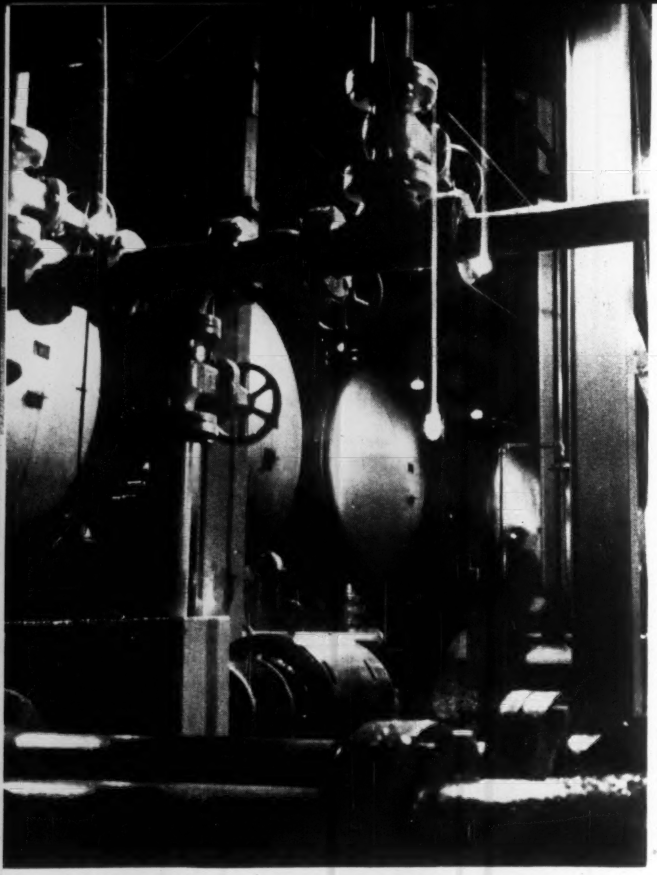
- In a number of cases, owners have complained of dust on walls and ceilings, thinking it should have been prevented by the air cleaning devices installed.

In several year 'round installations, such dust has been traced to mud which had accumulated on the dew wetted summer cooling convectors, to leeward of the air filters.

These convectors or evaporators dry off in winter, and the dried debris continually flakes off and reenters the air stream to be blown into the rooms. This is an argument for secondary air filters, which are being installed in many recent systems. No doubt that much dust, too fine to be caught by the primary air filters, condenses into larger and very objectionable particles as it passes along the ducts.

With multiple cell type filter installations, the owners are too prone to change all of the cells in any given unit when they need to change only a few of them. This, of course, greatly changes the resistance, increases the air volume, and encourages the carrying on of any dust which may have accumulated leeward of the filters.

SAMUEL R. LEWIS, *consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping, and air conditioning problems.*



Six basic factors are the keys to effective measurement of industrial piping maintenance: size of the maintenance job; size of the maintenance force; degree of maintenance efficiency; quality of maintenance; quantity of maintenance; accuracy of estimating. The author discussed several of these in the June HPAC, and covers the rest here.

BY ROBERT J. PINSKE

How to Measure Piping Maintenance

ONE of the basic objectives of management of any organization is the preservation of capital structures and values. Adapting physical facilities, financial policies, and operating procedures in an effort to make reasonable profits is a vital part of the problem of piping maintenance.

Presenting accurate figures concerning values, costs, results of operations, and figures on which far reaching decisions must be made will rest primarily on the fiscal officer, but he must have accurate information from the maintenance executives. How well management measures up to this responsibility will go far toward determining whether the company will operate efficiently with a minimum of expense for the piping system.

In addition to the usual valuation reserves, management should create reserves to provide for accelerated wear and tear, obsolescence, and deferred maintenance. No element of cost should be regarded as fixed or sacred. An attempt should be made to convert fixed expenses into variable, and hence, controllable items.

Conduct Periodic Surveys

Present and future conditions make it imperative that the cost system used in any particular plant be one which affords the greatest benefit to the company. Hence, it is necessary to re-examine cost systems and revise them when necessary.

Management should not be satisfied with historical piping maintenance costs. The following recommendations are offered to help management in its measurement of piping maintenance.

The importance of conducting a detailed survey of the whole piping installation at least once a year, and of keeping complete records cannot be overemphasized. These procedures soon reveal weaknesses and contribute greatly to safe continuous operation. If major modifications of manufacturing methods occur involving changes in pressure, temperature, or fluid volumes, additional surveys must be made. Then the influence of increased load on pipe strain, expansion, supports, vibration, and condensate drainage should be studied.

In plant operation, piping systems should be sectionalized, as the lack of isolating valves can cause great difficulties. Any individual section of piping should be planned so it can be cut out at will. Reducing valves, control valves, steam traps, and simi-

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The author is sales manager, heating and industrial division, Warren Barr Supply Co.

Other recent articles by Mr. Pinske on industrial piping maintenance have been published in the November 1956 through June 1957 issues of HPAC.

lar equipment should always be installed in a bypass with shutoff valves at both inlet and outlet to permit servicing or repair without stopping production.

The three most important items of piping expense, as found in the survey, are in the order of their importance: improper selection; dirt and foreign matter; and lack of maintenance.

Plan Job Procedure

The foreman or a staff assistant should look into the piping job and determine the work required. After preparing a list of materials and special tools needed, he should outline a step by step procedure for the most economical use of manpower and material.

Also, he should make provision for safety devices and instructions. Once methods have been established for repetitive jobs, the procedures can be filed and re-used. But they should be reviewed periodically to bring tools and techniques up to date.

Measure Work, Schedule Jobs

From basic standard data, a time standard must be given each job. Management must determine the elements and time values applicable to each pipe fitting job. They can be used by any plant, regardless of product. When the basic data is obtained, the elements must be combined to fit each operation. This simplifies applying time standards.

Important points to be set down in good scheduling are: required skill of the pipe fitter, which involves knowing the ability of each man; when the job should be done; and maximum overall time that can be taken for the job.

A time card rack for the direct assignment of work to the pipe fitters is generally used with success in most plants. One column of the rack is labeled for each man. The jobs to be done should be inserted in the proper space and sequence, and the time required for each job noted. Total for each man should be more than 8 hours.

Control Materials and Tools

Adequate repair parts must be maintained in stock at all times. The maximum amount of a given material that can be withdrawn from stores for a single repair order should also be established. Also, it is important to have the material at the point of need at the right time. A material delivery system should be integrated with the maintenance schedule.

A clear cut policy must be established as to what tools the pipe fitter is expected to furnish for himself and what tools the company will provide.

Also, it is important to maintain adequate inventory records of company tools to insure having enough tools.

Plan Preventive Maintenance

Statistical analysis techniques are important. Through their use, appropriate routine inspection cycles can be set, causes of failure assessed and controlled, and improved service rendered. The economic period between examinations is presumably that which gives notice of trouble without allowing it to develop. Any bias should be initially in the direction of too frequent inspection, as one premature failure will cost more than a number of unnecessary examinations. An examination period is too short if it continuously shows no change in condition.

A very important fact to remember is that the best ideas for improvements usually come from those closely associated with the daily problem.

Analyze Maintenance Cost

By analyzing all piping maintenance cost, it will be possible to compare the actual job time with the estimated time. When repetitive piping repairs occur, an analysis will indicate whether they can be reduced by the use of better materials or perhaps by an improvement in piping layout.

The effectiveness of a piping maintenance program can be judged only in relation to the physical conditions and management policies prevailing in the particular plant.

Ordinarily, it is evident that the maintenance of any particular piece of piping equipment depends on both the design and the use. It is not so evident that the piping maintenance may also be greatly affected by the operating and financial policies of the particular company. Piping maintenance is just a part of business, and until management begins to consider the combination of production cost, piping maintenance cost, and the capital structure of the business, the apparent cost of piping maintenance is apt to be misleading. ⌗

Natural Gas Reserves Show Greatest Year Gain

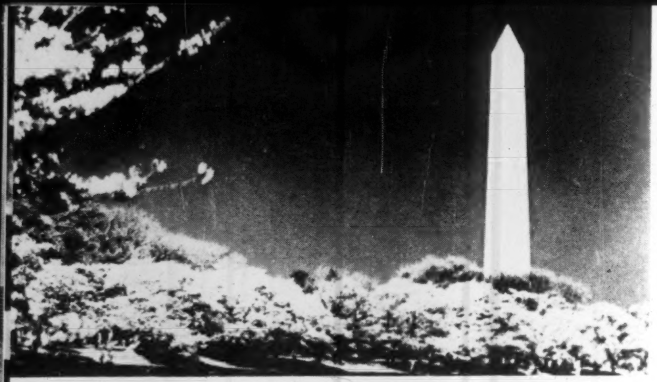
. . . reach 237.8 trillion cu ft

THE GREATEST recorded annual increase in proved recoverable natural gas reserves in the U. S. was registered during 1956, according to the American Gas Association and the American Petroleum Institute.

Reserves were increased 14.1 trillion cu ft during 1956 to an all time peak of 237.8 trillion cu ft. The previous record 1 year gain was 12.8 trillion cu ft, reported at the end of 1946. The average annual increase in reserves over the past 10 years has been 7.7 trillion cu ft.

Natural gas net production climbed to a record 10.9 trillion cu ft last year. This peak production, however, consumed only 44 percent of the 25.0 trillion cu ft added to reserves during the year through new discoveries, plus extensions and revisions of earlier estimates. The previous net production record of 10.1 trillion cu ft was in 1955.

Texas accounts for nearly half the nation's production and reserves. Its 1956 production of 5.3 trillion cu ft was 48.9 percent of the U. S. total; its reserves at year's end were 112.7 trillion cu ft, more than 47 percent of the total for the U. S. ⌗



How Government's Air Conditioning Program Is Shaping Up

To develop a better understanding of the need for and the economic values of air conditioning, 400 representatives from government and industry met in Washington recently. This government-industry symposium on air conditioning was sponsored and planned by the General Industrial Equipment Div. of the Business and Defense Services Administration of the U. S. Dept. of Commerce.

Recognizing that air conditioning is a modern necessity for all government installations in areas where it is warranted, they met with the purpose of:

1) *Pooling the knowledge of government and industry in an effort to obtain the maximum benefit of money and manpower spent on air conditioning, and*

2) *Laying the groundwork for an active program of government-industry cooperation in the study of present and future common air conditioning programs.*

Speakers included key men in both government and industry. Highlights of their talks are presented here.

Previous reports of the meeting were presented in the May and June HPAC's.

• air conditioning becoming accepted necessity, surveys show

"Today, air conditioning is considered as commonplace to most of us," said John E. Haines, vice president, Minneapolis-Honeywell Regulator Co. "But while we have been learning, since the 1930's to expect it in public buildings and to want it in our homes, many still consider air conditioning as less than necessary.

"Only during the past few years have limited studies been conducted to prove that air conditioning is essential in office spaces, hospitals, and manufacturing plants in order to improve the efficiency, productivity, and health of workers."

Admitting that there is very little sound scientific data to prove the percentage increase in office and factory workers' efficiency and productivity, or the speed of recovery of hospital patients, or the improvement in the learning of students through the use of air conditioning, Mr. Haines cited a few examples which he said "are more than interesting."

"The Detroit Edison Co. made an efficiency study in their drafting room a few years ago. Without air conditioning, 8988 work units required 5008 manhours. Following the installation of air conditioning, 10,474 work units required only 3872 manhours, indicating an increase in efficiency of 51 percent. This was reported in the October 1939 HPAC, p. 616.

"The U. S. government conducted a stenographic test in 1946 when stenographers typing triangulation data worked two weeks in a non-airconditioned space and were then transferred to an air conditioned space. Using the same typewriters, they increased their output 21 percent.

"After C. F. Braun and Co. moved into a new building with air conditioning, they reported a 35 percent increase in the efficiency of 575 white collar workers. However, some of this increase may have been due to better lighting and improved space arrangement.

"A task group of mechanical engineers from the federal construction agencies was appointed in 1954 to determine the necessity of air conditioning in federal buildings with the cooperation of the Building Research Advisory Board. In their report, issued in 1955, they said:

" 'Almost everyone agrees that air conditioning is worthwhile, but concrete evidence by which management can justify it does not appear to be available. Aside from the merits of air conditioning, it is rapidly becoming an accepted necessity.

" 'Additional work output of employees is not enough. Other factors must also be considered. These include: health, reduced absenteeism, good will, and lower personnel turnover.

" 'Only quality design and equipment should be considered.

" ' Central air conditioning will generally cost less than individual room units.'

"John Hardy & Son, manufacturers of nylon hoisery at Pulaski, Tenn., reported a 29 percent increase in production after installing air conditioning. The knitting machines required less maintenance, reflecting a cost reduction of 80 percent.

"A survey of 75 manufacturing plants in the New York city area indicated that 100 days in each year are so hot or humid that employees either slow down or stop work entirely during part or all of the day, and that an average of $108 in wages is lost each year for each employee working in a non-air conditioned building. Absenteeism dropped 25 to 30 percent after the installation of air conditioning, turnover in personnel was reduced, cleaning costs were lower, and productivity increased.

"The Aluminum Co. of Canada reported a sharp drop in absenteeism and rate of turnover among employees after air conditioned rooms were used where the employees could rest at regular intervals.

"The Elgin National Watch Co. reported that their rework decreased 25 percent after they added air conditioning and that employee efficiency increased."

Mr. Haines pointed out that Dr. L. A. Brouha, of the Du Pont Co.'s Haskell laboratory, has been studying the effects of high working temperatures on men for more than 10 years and has published reports on the resulting increases in heart rate, blood pressure, and oxygen consumption.

"Dr. Brouha's studies," said Mr. Haines, "and those of University of Illinois scientists sponsored by the American Society of Heating and Air-Conditioning Engineers, have proved that there is no ill effect when a normal person goes back and forth between cool areas and much warmer ones.

"Dr. Harmon, of Austin, Texas, has published data which tends to prove that students learn more quickly in a properly controlled environment.

"Nathaniel Glickman is conducting a very complete program at the ASHAE laboratory which should result in scientific data which should prove conclusively that air conditioning pays for itself in offices, factories, hospitals, and schools.

"Today, many doctors know that the individual control of the hospital room environment will help some patients recover more quickly. Some patients need warm and humid rooms, while others need cool and dry rooms, depending upon the illness. Considerable progress has been made in using air conditioning in treating allergic disorders, such as hay fever and pollen asthma, as well as other diseases, and for heat and cold therapy.

"Today, more than half of the hospitals in the country have air conditioning in some form in some area. Within

TABLE 1—AVERAGE AIR CONDITIONING COSTS of hospitals, industrial plants, and office spaces are shown here in relation to increased efficiency required for air conditioning to pay for itself

Type of building	Owning and operating building		Equipment and supplies		Salaries,		Complete air conditioning		Increased efficiency required for air conditioning to pay for itself,	Less than complete air conditioning (20 percent lower first cost)		Additional cost of owning and operating complete air conditioning	
	Cost per sq ft	Percent of total cost	Cost per sq ft	Percent of total cost	Cost per sq ft	Percent of total cost	Cost per sq ft	Percent of total cost	percent of payroll	Cost per sq ft	Percent of total cost	Cost per sq ft	Percent of total cost
New hospitals	$5.56	10.5	$19.80	37.3	$26.94	42.8	$0.76	1.4	2.8	$0.69	1.3	$0.07	0.1
Existing hospitals ...	4.76	9.1	19.80	37.8	26.94	51.5	0.83	1.6	3.1	0.75	1.4	0.08	0.2
New industrial plant	1.92	4.2	7.05	15.5	36.10	79.3	0.46	1.0	1.3	0.40	0.9	0.06	0.1
Existing industrial plant	1.33	3.0	7.05	15.6	36.10	80.2	0.55	1.2	1.5	0.47	1.0	0.08	0.5
New office building	2.91	4.1	2.00	2.8	66.00	92.3	0.56	0.8	0.85	0.48	0.7	0.08	0.1
Existing office building	2.07	2.9	2.00	2.8	66.00	93.3	0.68	1.0	1.0	0.57	0.8	0.11	0.2

The cost of a new building is based upon today's construction costs.

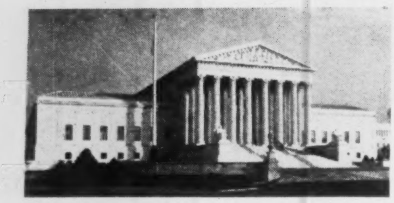
The cost of an existing building is based upon one-half of today's construction costs.

The insurance and taxes for commercial buildings are estimated at 2 percent of the original construction costs except that for public buildings such as hospitals and federal buildings no tax cost is included and the insurance is estimated at 1 percent.

The air conditioning cost is based upon a central fan system with a 20 year life, as recommended in the ASHAE Guide, with 5 percent of the original cost added for interest and 2 percent for insurance and taxes. Again, only 1 percent is added for public buildings.

The air conditioning costs do not include the heating costs nor the cost of the heating equipment because this is an attempt to compare the additional cost of year 'round air conditioning beyond the cost of a conventional heating system. These costs are based only upon outside wall areas. If there are interior areas, then the cost of air conditioning would be less than the estimates shown. These are the average air conditioning costs which have been prepared with the assistance of the Carrier Corp.

These are average costs based upon recent experience in all parts of the country. These estimates may vary somewhat with the design and geographical locations of the buildings.



a few years all modern hospitals will be completely air conditioned."

Regarding schools, Mr. Haines said: "Educators know that students learn more quickly in environments which are properly controlled. And this is particularly true of children who may learn to read twice as fast in classrooms at 70 F than at 80 F.

"We are building many schools, as we should, all over the country. Every effort is being made to reduce the cost of these schools. And yet, it is not generally known that only 10 percent of the expense of operating a school system is on the construction and maintenance of the school building. A reduction in the cost of the building and its facilities may very well increase the cost of the school system and reduce the value of the possibilities for learning. We are going to see more air conditioning in schools as parents and the public appreciate the importance of air conditioning as a teaching aid and as they learn that air conditioning will add very little expense to the overall cost of education. Also, the trend is toward the year 'round use of schools, either as classrooms or for other community purposes."

But the greatest and "almost unexplored" potential for air conditioning, he said, is the industrial plant, where the ratio of floor area in use as compared to office buildings is about 50 to 1.

"It is probable, said Mr. Haines, that less than 1 percent of all of our modern factories are air conditioned. Yet, we are living in a modern competitive system, and the factors of competition operate in a factory just as they do in the office building, hotel, or shopping center. We build buildings to create an environment for living, for working, and for industrial processes.

"Without the building, we canot create an environment. Without the proper environment, there is no purpose in constructing the building.

Working conditions are an imposing factor today, he pointed out. "Many firms exploit the fact that 'complete air conditioning may be enjoyed by the worker.'

"Training replacement personnel is a costly process. I understand that many government departments find 4 to 7 months are required as a minimum to train a new employee."

The average air conditioning costs of the three types of buildings selected for this symposium—hospitals, industrial areas, and office spaces—are shown in Table 1, as presented by Mr. Haines.

• air conditioning existing buildings can pay dividends

CHARLES S. LEOPOLD, consulting engineer, and a member of HPAC's board of consulting and contributing editors, directed his remarks specifically to government buildings of substantial construction.

"The air conditioning objectives for existing structures," he said, "are substantially the same as the objectives for permanent buildings at present in course of design and construction. Many of the government buildings constructed during the last 40 years have a remaining life which is commensurate with buildings presently being constructed.

"A system installed in a good existing structure should be equal in quality, performance, maintenance and, insofar as possible, appearance, to the system which would have been installed when the building was originally constructed, assuming that present knowledge, methods, and equipment for air conditioning were then available."

The objectives, he said, are:

"1) To maintain optimum temperature and humidity for general working spaces for mutiple occupancy.

"Interior zoning need only be carried to the point of maintaining the group optimum conditions.

"Interior conference rooms and electronic equipment areas require special treatment.

"2) To maintain desirable temperature and humidity conditions for offices of single occupancy which are usually adjacent to the perimeter of the building.

"The statistical data on optimum temperature for a group, in common with most other statistical data, fail to describe the optimum condition for any one individual in that group.

"Perimeter offices are subjected to the effects of sun and outdoor weather whereas the interior of the building presents a relatively simple cooling problem all year.

"Perimeter offices should be provided with:

"a) A means of heating beneath the windows sufficient to counteract the slide of cold air down the window and, to a degree, compensate for radiation from the body to the cold surfaces.

"b) Individual control of temperature over a reasonable range.

"As a minimum, office floors intended initially for multiple occupancy should be provided wih a means for readily changing to individual control of perimeter offices, should a change in the use of the building require the construction of private offices.

"The perimeter system should be capable of maintaining the desired conditions throughout the year and at all times meet the problem of sun exposure and cast shadows, whether by wings of the building or by other buildings.

"3) To provide adequate ventilation and air circulation without draft.

"Usually the control of odor will require more outdoor air than will the physiological needs. In this connection it is also desirable to keep the relative humidity below 55 percent as aiding in the suppression of odors within a building.

"4) All systems should have adequate air filtration for relatively coarse dust: namely, dust of the size where the individual particles can be seen. In industrial atmospheres, or where there is appreciable soot or oil fumes, additional filtration, such as electrostatic or diffusion type, may be justified.

"5) The system should be capable of maintenance by personnel of average intelligence and the automatic controls should be selected with this thought in mind.

"There should be ready access to all parts of the apparatus for maintenance. This does not necessarily mean a large apparatus room but that access should be carefully considered during the planning stage.

"Where possible, it is desirable that maintenance be confined to a few large areas, rather than many small areas.

"6) The capacity of all components of a system should be adequate for the maximum duty for which the system is designed. Gross oversizing is to be avoided as wasteful and, at times, adding to the complications of controlling the system.

"7) The apparatus and air distribution systems should operate free from objectionable noise and vibration.

"8) The system should be installed so as to have a minimum adverse effect on the appearance of the building.

"9) The system should occupy as little useful space as is feasible."

Mr. Leopold continued: "Buildings in general, office buildings in particular, are conditioned so that the occupants may work without the discomforts due to temperature, humidity, noise, and dirt. Conditioning such a space provides more pleasant living and, as such, is one of many considerations in the employer-employee relationship. This phase may be the major consideration, particularly for our government, which must compete with the more flexible wage scales of private industry.

"In an office building with adequate windows, in the absence of air conditioning, employees tend to blame nature for their discomforts but the moment it is air conditioned, and the windows closed, management assumes responsibility. It would seem, therefore, that if management—in this case our government—is to obtain the return on its air conditioning investment, discomfort and complaints must be avoided. There would appear to be little justification for an installation which appreciably compromised with optimum results.

"For example, let us assume that the difference in first cost between a system with mediocre results and one with first-class results is as much as $2.00 per sq ft. Government buildings, in general, average approximately 115 sq ft per occupant, representing an investment of $230 per government employee. Assuming a 30 year amortization and interest at 3.5 percent on the unamortized balance, the annual fixed charge would be approximately 5.2 percent or $12 a year per employee. Should salaries average $4000 for the period of amortization, $12 would represent 0.3 percent of salary.

Regardless of whether or not improved efficiency because of good air conditioning can be demonstrated for all office work, air conditioning is a definite factor in the employer-employee relation and important in the competitive market for labor."

Mr. Leopold described two typical installations which he said illustrate the foregoing design criteria.

"The 30 story Fidelity-Philadelphia building, completed in 1928, has a rentable area of over 600,000 sq ft and is considered by many to be the No. 1 office building in Philadelphia. Preliminary plans and first and operating costs were prepared in 1953 for a number of air conditioning methods. The cost estimates included an annual charge for the loss of rentable area for any space to be occupied by the air conditioning system. The cost analysis indicated that the systems which required the minimum of rentable area, though somewhat higher in first cost, were the desirable systems in overall cost."

(This 2500 ton central installation was discussed in the article *Office Building Keeps Pace—Installs Complete Air Conditioning*, by James Bricker, in the January 1955 HPAC.)

"The loss of rentable space due to the air conditioning installation," said Mr. Leopold, "was 0.25 percent of the total rentable area, and in these small parcels it did not interfere with existing office layouts. Even this figure is somewhat misleading as some windowless space was recovered which prior to the use of air conditioning could be used only for storage.

"In this building the finished appearance of the perimeter offices was much as it would be if the building were constructed today. The interior is quite similar with the exception that where acoustic ceilings have been added they would initially have concealed the ducts, whereas, as of now, some interior ducts are exposed. This is not a permanent limitation, as enclosure can always be effected if desired.

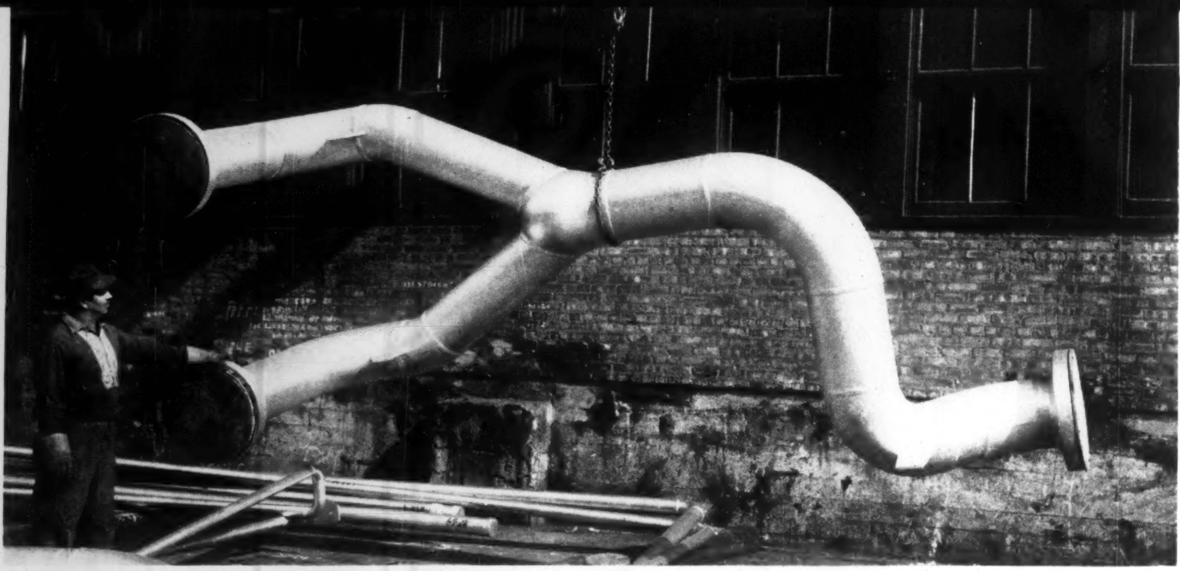
"The air conditioning of this building complies substantially with the criteria previously discussed.

Another example he gave was the air conditioning of the U. S. Capitol, which, he said, "presented some unusual problems." (This installation was discussed in the July 1956 HPAC, and in the July 1938 HPAC.)

"Construction of the Capitol extended from the latter part of the 1700's to the early part of this century," Mr. Leopold pointed out.

"The Capitol was completely air conditioned in 1936. The House and Sentate chambers had been conditioned in 1929. A substantially new system for the House and Senate chambers was installed in 1950, incident to the complete renovation of the chambers.

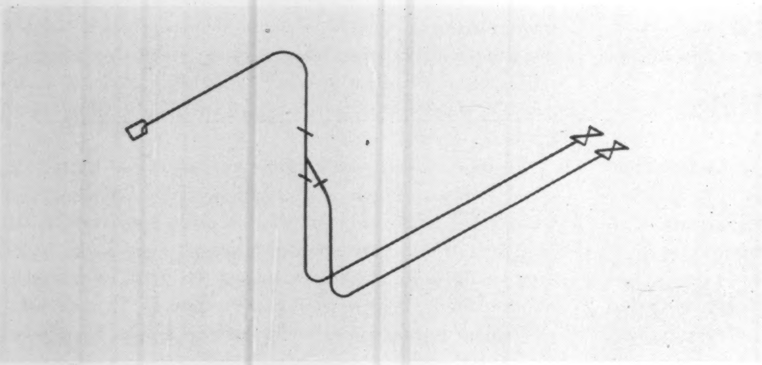
"Appreciable interference with the appearance of this building was unthinkable. Despite the limitations imposed by the structure, the air conditioning system was successfully installed," he concluded. ≠



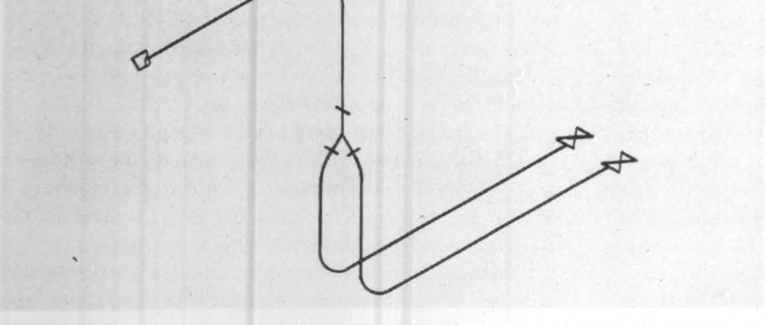
1 TEAR DROP CONSTRUCTION here reveals simplicity annd compactness of design achieved in large, heavy wall piping

How to Design Dual Piping

BY G. W. HAUCK
Manager of Engineering Sales
Crane Co.



2 LATERAL TYPE Wye connection for dual steam inlets is one of simplest designs for dual piping connections

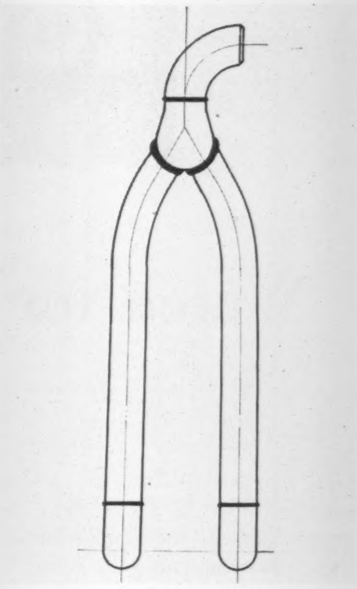


3 TRUE Wye connection, as shown here, for dual steam inlets is preferred over lateral form

STEAM TURBINES of large generating capacities, as used in modern central station installations, utilize dual steam inlets and reheat piping connections. When designing the main steam or reheat piping, achieving the transition from one lead into dual leads presents some problems.

The division of the main piping into two branches should reflect simplicity in the design. It can be accomplished in several ways. The simplest is a Wye connection, using a lateral form as shown in Fig. 2, or a true Wye form as in Fig. 3. The latter is the preferred type.

The cross section of a forged true Wye fitting, sometimes called a "tear drop" forging because of its shape is shown in Fig. 4. This type of forging has been used successfully in a number of piping installations. These have been chrome-moly steel forgings in most cases; a few have been carbon steel. This special fitting

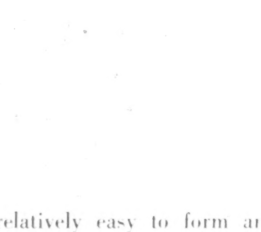


5 TWO PIPE BENDS are welded to holes in extra thick section of tear drop forging without extra reinforcement

Connections for Steam Lines

. . . simplify main steam and reheat piping transitions

is relatively easy to form and machine. Its spherical shape permits adequate distribution of metal, making it structurally sound. Its weight can be kept to a minimum, an advantage in the suspension of the piping.



4 TEAR DROP FORGING — shown in cross section of true Wye fitting — is structurally sound, light in weight

It will be observed in Fig. 4 that extra thickness of metal has been provided for the section where holes are to be cut for the two welded branches, as shown in Fig. 5. The extra thickness compensates for the loss due to the cutting for nozzles, thus eliminating any need for reinforcement of the nozzle welds by means of rings or saddles. The final result is a compact design.

These tear drop forgings are designed in each case for the specific pressure and temperature conditions and to comply with applicable codes. Non-destructive testing assures the soundness of the forgings.

The dual branches are welded to the tear drop forging as shown in Fig. 5. Each branch is usually at an angle of 30 deg from the center line of the inlet. The total angle between the two branches is 60 deg.

The simplicity and compactness of design that are achieved in large, heavy wall piping using this tear drop construction, are illustrated in Fig. 1. This shop fabrication was stress relieved in a furnace. The welds were checked with radiography, and the interior was cleaned by pickling and shot blasting. The assembly was produced for central station piping.

This is a typical tear drop forging in an assembly for a cold reheat line, designed for 410 psi at 645 F. It is made of Schedule 80, A-106, Grade "B" carbon steel. The inlet is 16 in. in diameter, and the two branches are 12 in. in diameter. +

The author has written many articles on the subject of piping design, installation, and operation for HPAC. He is a member of HPAC's board of consulting and contributing editors.

The Law and Your Profits

BY WILLIAM HURD HILLYER

Watch for Unintentional Guaranties

YOUR representation may assume the force and effect of a guaranty. The party offering the representation must walk a narrow path, carefully avoiding too much enthusiasm and yet displaying enough to make his sale. The case which follows show such dangers clearly.

Air conditioning is necessary in the Naughtsville Warehouse Co. A temperature of not more than 68 F is required in one of the rooms for special conditions. The Athermo Equipment Corp. contracted to sell a cooling unit for this section, designed to produce the requisite low temperature, even with the thermometer outside registering 100 F. This was embodied in a letter from Athermo to Naughtsville, reading substantially as follows:

"We take pleasure in quoting on the following refrigeration equipment . . . 16 ft, 7 in. wide by 30 ft long by 7 ft, 10 in. high. It will remove 15,900 Btu per hr based on 18 hr per day operation when the outside temperature is 100 F and the inside room temperature is 68 F.

A 17 item list of equipment accessories has been omitted.

"Price of above equipment $932.00 f.o.b. Naughtsville."

The company bought the equipment offered by Athermo and installed it in late October. The unit worked properly until the Southern sun lifted the outside temperature to 85 F the following May. Then the Naughtsville general manager noticed that the desired conditions were not being maintained. He checked the floor and found that it was not insulated. Straightway he ordered cork insulation to be installed. No appreciable improvement resulted.

Later additional insulation was installed on the walls and ceilings without avail. At length it became apparent that the cooling equipment lacked the required capacity.

The cooling people were given the opportunity to supply an auxiliary refrigeration unit at their expense. This they failed to do. The warehouse company therefore purchased the additional equipment from another source which was easily able to maintain the 68 F temperature.

Based on the letter above quoted, Naughtsville sued Athermo, alleging that misrepresentations were "wilfully" and "recklessly" made. However, the complaint in one of its counts admitted that these representations might have been offered without knowledge of their falsity. The circuit court awarded Naughtsville a $2,214 judgment to cover damages "for the expense involved in the purchase and installation" of the auxiliary unit, "insulation and service charges, loss, and interest on these items" beginning with the date of filing the complaint.

From this judgment Athermo appealed. He contended that there was no misrepresentation, because his representation (see letter) was that this specific refrigeration unit would remove 14,900 Btu per hr, whereas there is no evidence that this unit would not remove 15,900 Btu per hr. Furthermore, Athermo urged, Naughtsville's manager had requested a cooling unit for one room in his warehouse for certain conditions to be maintained, that is, denoting certain minimum cork insulation. The evidence was insufficient to show that the Athermo unit would not adequately cool such a room of the same dimensions as Naughtsville's.

"It is our opinion," ruled the supreme court, "that the appellants' [Athermo's] conclusions are not supported by the evidence." The cooling concern's expert "examined this particular room, and it is clear that the representation he made" to the warehouse company "was that the specific unit described in the letter would serve the needs" of Naughtsville "with reference to this particular room." The court deemed it plain that the warehousemen, relying on representations made by the Athermo expert, purchased the specific unit offered. "It is undisputed," the learned justices pointed out, "that the unit specified in the letter failed to cool this room in the manner represented."

The higher court cited a State law providing that in order to prove an action of fraud, it is not necessary that the misrepresentations relied upon should have been wilfully made or even recklessly made.

WILLIAM HURD HILLYER, *author of this regular feature, is a contributor to a number of banking and financial publications and has written several books on business. He has an extensive practical legal and financial background.*

This series presents actual cases. Naturally, laws vary in different states. All names are fictitious.

U.S. Army's Old Heating Plants Go Modern, Efficient in Japan

Increased efficiency and economy through heating plant improvements in the last four years have cut the Army's heating bill in Japan this year to less than half of what it would have been without improvement. A preceding article was in the June HPAC.

BY WILLIE HAMMER
Chief, Heating Unit Repairs & Utilities Div.
Office of the Engineer
HQ, Army Forces, Far East

EACH BOILER PLANT was surveyed to determine which fuel would be most economical. At first, it was thought that diesel oil might have to be used in plants which would use liquid fuel. But after coordination between Army Engineer, Quartermaster and Transportation Corps personnel, arrangements were made to handle, transport, and use Navy Special Fuel Oil (No. 5 oil). As discussed later, the supply of coal in Japan was limited.

In 3 years, the number of hand fired boilers was reduced by conversions, release, or inactivation by interconnection with other plants from 271 to 13, all of which will be either released or converted to oil by next year. At one plant having nine hand fired Lancashire boilers, the number of workers was reduced from 41 to nine; efficiency and output per boiler were increased; and an estimated saving of $100,317 was made for the first year.

In one boiler plant 32 men served seven hand fired boilers which lacked capacity to satisfy the connected load during a cold day. After this plant was converted to oil, five boilers not only served the system satisfactorily, but another building which had formerly used 56 electric space heaters was added to the load. Personnel required was reduced to 10.

Estimated Saving in 1956-57 $4-5 Million

During the first year of conversions, an annual saving of $264,045 was made at a total cost of $101,150; and by the end of the third year the total saving was over $2½ million at a conversion cost of approximately $1 million.

At the beginning of calendar year 1956, it appeared as though the point had been reached at which further conversions could not be amortized in 2 years. However, in June 1956, the average price of Japanese coal supplied to the Army rose to $15 per ton compared with $9.46 for the previous year. It was then decided to convert as many plants as possible with funds available. It is estimated that if no conversions had been made since 1954, the heating cost for Army installations in Japan would be $4 to $5 million more during the fiscal year 1957 than its expected cost.

Oil solved other problems:

1) The reductions in manpower decreed by higher headquarters were ameliorated by these changes in fuel. Since its inception, more than 1000 personnel spaces have been eliminated by the conversion program.

2) Less training is required to permit operators to obtain high plant efficiencies with oil.

3) Fuel losses in handling and storage were eliminated.

4) Areas formerly required for coal storage were released for other purposes.

5) The necessity of ordering fuel 6 to 9 months in advance of use was reduced.

6) Consumption data and efficiency calculations are more reliable with metered oil.

7) Boiler plant maintenance, housekeeping, and personnel morale have improved.

8) Coal procurement problems were reduced.

9) Smoke nuisances in metropolitan areas were eliminated.

10) The cost of heating broke from its dependence on the local, fluctuating price of coal. Oil, obtained from the Persian Gulf area by the U.S. Navy on a favorable, long term contract, is less subject to change in price.

To reduce heating costs further, boiler plants were interconnected wherever possible to permit one or more to be shut down. In one case, the conversion of a hand fired coal burning plant permitted it to take over the loads of two other plants after they were interconnected.

At another camp, separately fired hot water generators and the 32 persons required for their operation were eliminated by installation of heat exchangers using steam supplied from a large central plant.

Warm Air from Steam Tunnels Used

A campaign to conserve heat and fuel was begun. A directive was issued through command channels indicating that a conservation officer would be appointed at every camp. A pamphlet was written and distributed indicating steps which could be taken by commanders, supervisory personnel, operators, maintenance people, and consumers to save heat and fuel. Posters were designed, printed, and distributed. Announcements regarding fuel conservation were printed in camp bulletins, troop information programs, and in the Pacific edition of "Stars and Stripes," and spot announcements were made over the radio stations operated by the Armed Forces Far East Network.

One camp installed operating instruments in its boiler plants and found that 12 of the largest boilers had very high flue gas temperatures. A trial economizer was fabricated in the shops of the camp and installed in one boiler. The efficiency of that boiler increased 8 percent. During the following summer, improved economizers were built and installed in the other boilers.

At the same camp, a small part of a housing area was heated by a circulating hot water system supplied by a large boiler plant, but the rest of the houses were heated by electricity. Electricity in Japan is usually in short supply due to expanding industrial needs, and expensive for heating because of loose construction. A program was initiated to use the boiler plant to heat all the buildings in that area, with a resultant drop of 9,289,993 kwhr in electrical consumption. A directive that electric heaters would not be used in spaces having operable steam or hot water radiators resulted in the removal from use of almost 1000 2-kw heaters.

The engineer in charge of one boiler plant, looking for ways to increase the operating efficiency, considered the use of preheated air. Installation of air preheaters would be expensive. However, he remembered that the heat losses of the piping in the tunnels of his steam distribution system warmed the surrounding air. He now draws warm air from the steam tunnels to use in the fire boxes of his boilers.

Compute Costs, Fuel Quotas for 100 Hp Plants

Cost accounting records and fuel utilization targets have been used for each camp as a whole. However, because facilities within each camp are so varied and so widespread, data is frequently unusable to pinpoint plants with high operating costs.

To correct this situation and to determine precisely which plants are operating efficiently, a system is now being initiated to compute operational costs and fuel targets for each boiler plant with capacity of 100 hp or more. This information will be determined at the boiler plant itself so that the operators will know how well they and their plants are performing. Action will be taken to concentrate corrective action on plants with high operating costs.

All high pressure boilers are now inspected twice a year by a qualified inspection agency which uses the "Code for Power Boilers" of the American Society of Mechanical Engineers as a guide. As much as possible economically, the boilers are brought to the standards of the code.

Without Improvements Cost Would Be Double

The question may now arise, "How much has all this saved?" It has been pointed out there are so many improvement, modernization, and conservation programs going on at once, plus the release of facilities from time to time, plus changes in cost of fuels, plus the necessary relocations of military units, that it is impossible to determine exactly what effect any one factor has had.

For example, at one camp four coal burning hand fired plants were converted to use oil as fuel. From operating logs for 1 year under each fuel system, the amount of fuel used was determined, and from pay records the labor cost was established. From these two, it was found that a saving of approximately $277,333 and a reduction in operating personnel from 131 down to 37 had been made with a conversion cost of less than $100,000.

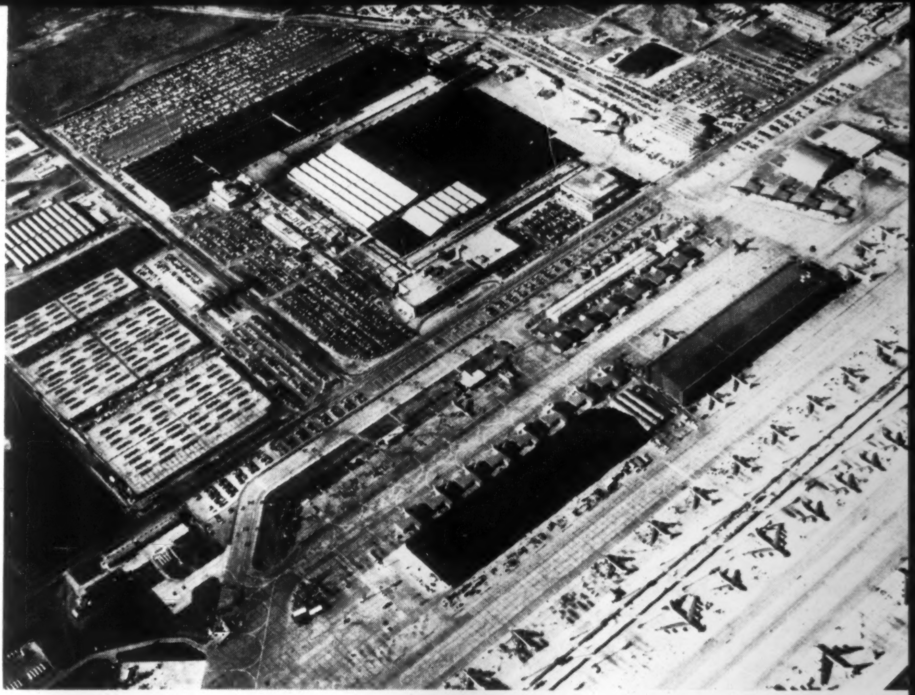
However, during and after the conversion, operating instruments were installed, repairs and improvements were made to the distribution systems, the number of buildings heated and the number of occupants increased, two plants were interconnected, a new heating engineer was put in charge, the two years had slightly different numbers of degree days, and a conservation program had been put into effect. There was no way to determine what part of the total saving was attributable to any one of the listed factors.

But in the two Army areas in Japan in which fewest changes in facilities have been made, the volume of occupied building space increased 1.4 percent from June 1953 to June 1954, yet nonelectrical heating costs decreased by 11.3 percent. From June 1954 to June 1955, occupied building space decreased by 8 percent, while nonelectrical heating costs were reduced by 24.0 percent. Total cost of nonelectrical heating of all Army facilities in Japan was reduced by all causes and means from more than $23 million during fiscal year 1953 to $11,359,000 during fiscal 1956 and is expected to decrease to approximately $8 million during fiscal year 1957. Without all the improvement programs, heating costs for the fiscal year would be more than twice as high.

Efficiency Program to Continue

There is still a great deal of work to be done. At some camps, the capabilities of operating engineers are not equal to the requirements of the programs they must carry out. Improvements at those camps are not as extensive as those at camps with more capable engineers. Some operators make entries on their operating logs of metered readings but are still unfamiliar with the significance of the readings. They also miss danger signals until it is too late. Instruction will be continued until the logs are properly utilized for their designed purposes.

Installation of economizers, air preheaters, and feedwater heaters to utilize heat in gases and steam formerly wasted will be continued. The use of automatic devices will be increased as American controls are received and installed. Maintenance must be improved continually. Wherever economical, equipment is being removed from facilities to be released and will be relocated in retained facilities to improve heating systems. +



How Boeing Operates and Maintains Plant Heating and Air Conditioning

"Like clockwork" describes the air conditioning maintenance procedures required to keep this system in operation, at first 'round the clock, and now 16 hours a day. Keyed to prevention, with emphasis on cleanliness, this program is set forth here as described by the plant engineering staff.

An important part of the preventive maintenance program for the air conditioning systems installed in the Boeing Airplane Co.'s Wichita, Kan., plant is cleanliness of the equipment, according to the plant engineering staff.

This equipment was installed in Boeing's government owned 170 by 270 ft Plant II administration building in 1942 and was operated by the company for four years, until the plant was deactivated in 1946. Taken over by the War Assets Administration and operated by that agency until 1948, the facility was then reactivated for Boeing's production of B-47 Stratojet medium bombers.

Thus, the air conditioning system has been in operation since the date it was installed. On an average, the system operates 16 hours a day during nine months each year.

Maintenance employees keep a written log, consisting of such items as head pressure, back pressure and oil pressure, and temperatures of entering chilled water, leaving chilled water, entering conditioned water and leaving conditioned water. This data is recorded every two hours on the first two shifts and three times during the third shift each day.

Operate 67 Separate Systems

There are 67 various year 'round air conditioning systems in operation in the plant. Although each of these systems is basically the same, nearly all have varying construction and individual components peculiar only to that one system. This variance is the result of each system being designed and constructed to meet the specific needs of the area to be served. Because of the individual peculiarities, each system is briefly analyzed here.

One of the largest and most complex is System No. 15 for the administration building. It serves a larger area than the other units and requires far more servicing and care.

THE AIR CONDITIONING SYSTEM has been in operation since it was installed, on an average 16 hours a day, nine months of the year

This large system is composed of three smaller systems: one system of cooling equipment, one primary system of heating equipment, and one secondary system of heating equipment.

The cooling system and the primary heating system condition the air in the building through fan-filter-water coil units, located to feed each of 14 zones. These 14 zones are served by individual remote conditioning units which are equipped with their own separate duct systems. These duct systems are further divided into subzones through the use of automatic motorized volume dampers.

The cooling equipment is composed of four 100 hp condensing units, four water chillers, two condensing water pumps, and a forced draft cooling tower equipped with two blade type fans.

The primary heating system includes one steam heated heat exchanger installed in the machine room.

Two circulating pumps, in parallel, circulate water through a double piping system to each of the 14 conditioning units. The temperature control on each fan unit is a three way motorized valve which either causes water to be delivered to the unit through the supply pipe or returns the water to the return pipe through a bypass. Whether or not the water goes into the supply or return pipe depends on whether the valve is open or closed. This circulating water can be controlled to flow through the chillers or through the heat exchanger by the manipulation of hand valves.

Temperature in each zone is controlled by a modulating controller of the remote bulb type, with its feeler bulb in the return air duct. This controller regulates a modulating motor which drives the three way water valve.

A second controller of the same type, with its feeler bulb in the discharge air duct from the fan unit, acts as a low temperature limiting device. When the discharge air temperature from the fan unit falls below the setting of this controller during the heating season, the motorized valve and bypass are driven 50 percent closed. This causes more hot water to flow through the water coil, and it raises the discharge air temperature.

On fan units Nos. 1, 3, 12, and 13 the return air controller has been replaced by a modulating room thermostat. These thermostats are in representative parts of the zones controlled.

Return air ducts and grilles on these units are such that the air is not returned from a reasonably representative part of the zone. Close control through the use of air controllers is therefore impossible.

The temperature control system on each of the 14 units is provided with two manual tumbler switches on the side of the respective terminal boxes. The lower of the two switches, marked "Summer-Winter," reverses the action of the control in relation to the controller, so that in its upper position the three way valve will open the bypass on temperature fall, while in its downward position the three way valve will close the bypass on temperature fall.

The top switch of these two will, in its upper position, cut the discharge air flow temperature limit controller out of the circuit so that the temperature below which this air may fall is not controlled. In its downward position the low limit control is in the circuit and can operate the three way valve as previously outlined.

Duct systems on fan units feeding zones on the south and west sides of the building are provided with motorized volume dampers whose purpose is to compensate for radiant heat from the sun through the outside walls of these zones. These dampers control the volume of air supplied to the ceiling louvers immediately adjacent to the outer walls. Motors on these dampers are modulating, and are regulated by room thermostats mounted on a pillar in the first row of pillars inside the outer wall. A tumbler switch buried in the pillar behind a blank switch plate, and immediately below each of these controllers, can be operated to reverse the action of the damper in relation to the control in order that the damper will close on temperature rise. During any time that the discharge air temperature from a fan unit is lower than the return air or room temperature, these controllers open the damper on temperature rise. Except under very unusual and extreme conditions, the supply-return air temperature relation is sustained.

One Exchanger Provides Secondary Heating

The secondary heating system consists of one steam heated exchanger near a corner of the equipment room. The water heated in this exchanger is circulated in three zones by a circulating pump for each zone. For each zone a two pipe system serves convectors connected in parallel. The convectors are under the outside windows around the perimeter.

The purpose of this system is to compensate for heat transfer through the walls and windows. Since this rate of transfer depends on outside temperature and wind velocity, the system is compensated so that the temperature of water passing through the convector varies inversely from the outside temperature.

This secondary heating system is zoned vertically. No. 1 heating zone pump feeds all convectors on the east side of the building on all three floors. The No. 2 pump feeds the convectors on the south side of the building and the south half of the west side. No. 3 pump feeds the north side of the building and the north half of the west side.

Zone Pump Bypasses Prevent Overheating

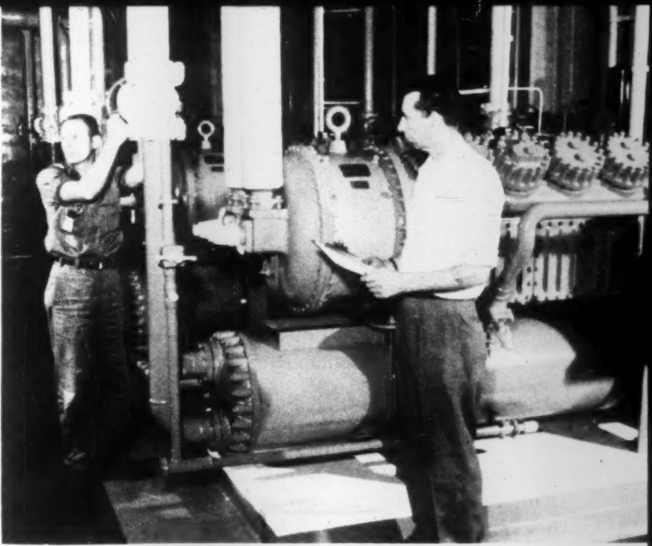
A standard compensated control system which varies the temperature of the circulated water in relation to the outside temperature is the primary control system for this heating system. Details of the operation and structure of this control system are available in blueprints of the building and control manuals.

Because heat loss through the walls and windows of the building varies directly with the wind velocity at a given temperature, it is necessary that the type of compensated convector control system used here be designed and adjusted to offset the heat loss at the lowest expected temperature combined with the highest expected wind velocity. Since the controller used as the compensator reads temperature only, a system so designed can produce overheating at lower than maximum wind velocity at any given temperature.

To offset this factor, the No. 2 and No. 3 zone pumps are provided with bypasses from the return water header to the suction side of the pumps. A three way valve is provided at the junction of the pipe leading from the pump inlet, the discharge header from the heat exchanger and the bypass. As the bypass is opened, water is drawn from the return water header directly into the pump, bypassing the heat exchanger and allowing the temperature of water supplied to the convectors to be reduced. The three way valves are operated in each case by a modulating motor. Each motor is regulated by three modulating room thermostats connected in a standard averaging circuit, shown on building blueprints, and explained in the control manual. These controllers are near the effective range of the convectors in their respective zones.

No. 1 heating zone serves the same purpose as Nos. 2 and 3. However, the space adjacent to the east wall is broken up into small offices. The internal heat load may vary considerably between these offices. The convector, or convectors, in each office are therefore individually controlled by their own system.

This system is a series 20 motorized water valve and room thermostat arrangement. The bypass on No. 1 heating zone pump connects the suction and discharge sides of the pump. The control is a motorized shutoff valve operated by a modulating motor. The controller is a modulating motor. The controller is a modulating pressure sensitive device exposed to discharge pressure on the pump. As the water valves on the convectors in the various offices are closed off, pressure on the pump is increased. This increase causes the controller to drive the modulating motor, opening its bypass.



DAILY MAINTENANCE REPORT is checked on the operation of four air conditioning units that cool the administration building

The purpose of the control system in all three zones, as outlined above, is to prevent overheating resulting from lower than maximum wind velocity at a given temperature. The controllers are therefore high temperature limiting devices. They should be set to come into operation at the highest allowable temperature in the affected space.

Supply Up to 75,000 Cfm of Air

Ventilation equipment consists of one variable speed fan in a penthouse on the roof of the building. This fan is capable of delivering a maximum of 75,000 cfm of air at a maximum of 1.125 in. water gage velocity pressure. It is of the rotary, reverse pitch, nonoverloading type. Speed control is manual.

Air entering the building through this fan is filtered through a bank of cleanable metal filters on the discharge side of the fan. Low temperature of this air is controlled by a steam heated tempering coil and face and bypass dampers in the penthouse on the downstream side of the filters. The controls of this system are in the outside air duct to the No. 11 fan unit. It has been found that in order to prevent overheating of some sections of the building at a minimum of about 38,000 cfm of air required for ventilation, the controls should be set at approximately 35 F. Minimum air for ventilation with the building fully occupied corresponds approximately to No. 6 position on the manual for speed control lever.

After passing through the tempering coil, ventilating air passes down a supply air shaft, then through ducts to the mixing chambers of the various conditioning units. Entry of this air into the mixing air chambers is controlled by a motorized damper on each unit.

Each of the 14 fan units is equipped with a remote bulb type of mercury switch controller. The remote bulb is inserted in the outside air duct. This controller is set at approximately 75 F. When the outside temperature is above the setting of this controller, the motorized damper in the outside air duct is manually positioned by a hand potentiometer inside the terminal box for each unit.

When the outside air temperature falls below the setting of this controller, it acts to bring modulating type room thermostats in each zone into the circuit. These room thermostats can then modulate the outside air damper from open position to the position at which the hand potentiometer is set. That is, if the hand potentiometer is in the closed position, the room thermostat can drive the outside air damper motor from "open" to "closed" and vice versa. If the hand potentiometer is in the 50 percent position, the room thermostat can drive the outside air damper completely "open" which can be made to stay in that position by setting the hand potentiometer in the "open" position. But on temperature fall the room thermostat can only drive the outside air damper to 50 percent position.

During the heating season, when the hand potentiometers are acting as minimum positioning switches, and provided the room thermostats are properly adjusted, as will be subsequently explained, the potentiometers can be set in the "closed" position and left there.

Exception is made in the case of No. 11 unit where in order to insure passage of sufficient outside air, the feeler bulb of the controller controlling the tempering coil to allow it to operate the hand controller, should not be set more than 75 percent toward its closed position.

During the cooling season, when control of the outside air dampers is manual, the maximum volume of outside air that the cooling system will handle without raising the temperature in the various zones is ordinarily used.

A relay, activated by the power circuit to the fan motor on each unit, acts on the control circuit to the outside air damper so as to shut off the outside air, regardless of the position of any other controls when the fan is stopped.

Outside Air Throttled If Primary Heat Fails

The room thermostats regulating the outside air control during the heating season are in representative areas in the 14 zones. The function of this controller is to throttle off the outside air when failure of the primary heating system allows the area to become too cold. It is therefore a low limit controller and should be set at the lowest allowable temperature for the zone it serves. When one or more outside air dampers in the building start to throttle and the operator has satisfied himself that the temperature at the respective controllers cannot reasonably be allowed to fall any lower, then he investigates the possibility of slowing down the main input fan, bearing in mind the requirements for minimum ventilation. If that fails, he investigates the possibility of steam pressure failure and the possibility of raising the tempering coil temperature without overheating any part of the building.

During summer operation, a considerable reduction in load on the cooling equipment may be effected by opening dampers in the exhaust air grilles, allowing the air to escape into the attic spaces before it reaches the fan units. This air, since the attic space acts as plenums for the exhaust system, will carry off a large portion of heat generated by fluorescent lighting ballasts.

Vary Pressure to Offset Infiltration, Leakage

The exhaust system consists of 11 fans in various parts of the building. Four of them are controlled from pushbutton stations on the main control panel in the equipment room. These fans exhaust from rest rooms, and because of the necessity for odor control, they must run at all times.

One fan in the tunnel north of the equipment room and controlled from a pushbutton station immediately below the tunnel, exhausts air from the equipment rooms and usually is operating.

The remaining six fans are on the roof of the building and are controlled from pushbutton stations in No. 11-12 fan room. Two of these fans remove air from three floors of the building. The number of these last six fans in operation is such that a slight pressure is maintained on the building. This will counteract as far as possible air leakage through doors and around windows.

A considerable building pressure is maintained at times to offset outside wind pressure. In those temperature ranges where the ventilating system opposes the temperature control system in operation, heat loss or gain through excessive ventilation will probably prove more costly than the loss or gain through infiltration. The static pressure accepted by most engineers as the most economical level for this purpose is 0.08 in. to 0.10 in. WG.

The ventilation-exhaust system is not considered a part of the temperature control system. Design data indicates that control of temperature through the range between 38 and 44 F might be possible in some zones by this means.

This, however, depends on wind, temperature, and humidity conditions. The cooling system is turned on when the outside temperature reaches 45 F and is rising. The heat is turned on at the same point if the outside temperature is falling. One or the other of the systems is always in operation. Too great a delay in changing from one system to the other would cause an override in the system just started. ‡

Another article on the subject in which the maintenance features are discussed in detail will appear in an early issue of HPAC.

How to Erect High Pressure Ducts

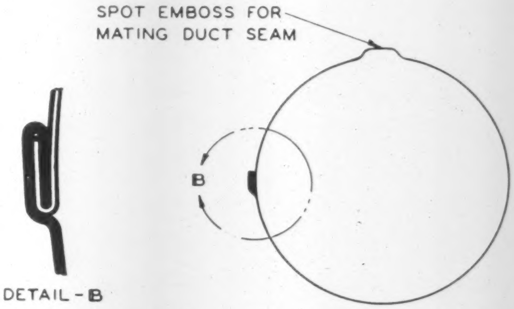
. . . *for air conditioning systems*

The methods and techniques given here have been used in the shop and in the field. They were adopted, says the author, with the sole purpose of economy in mind, but not at the expense of endurance and quality.

BY K. A. J. MONIER
President
A. J. Monier & Co.
Mechanical Contractors

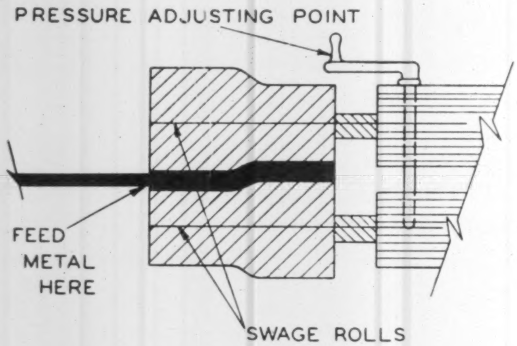
THE WORDS high pressure and even medium pressure cause too much concern to the industry as a whole. Actually, duct construction methods and procedures for conventional air conditioning systems, as well as forgotten practices of blowpipe and exhaust systems, are practical and adequate for the so-called high pressures.

Naturally, throwing all economy requirements to the winds, nothing could be better than a completely welded or soldered job with heavy gages or with much use of sealants, adhesives, and tapes. With the point of view of not belittling these methods but of offering satisfactory and more economical substitute procedures, the following proven techniques are offered.

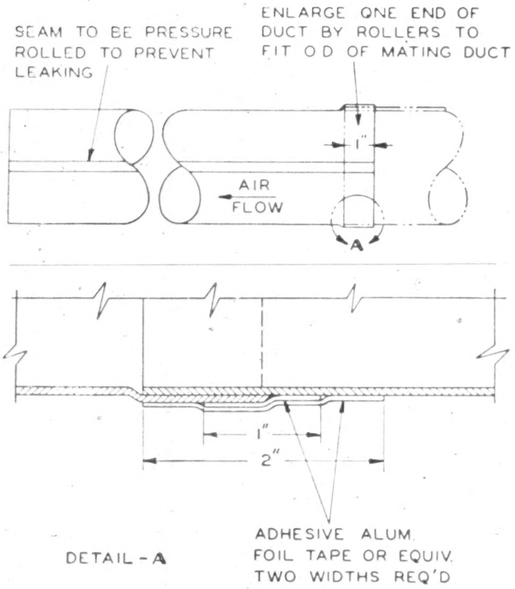


1 PITTSBURGH LOCK, shown in finished form here, is formed by using a standard lockformer and then an electric stationary grooving machine to tightly fold the metal. With this joint we have been able to hold pressures up to 20 in. water gage without any additional sealant applied to the groove before folding. The even pressure and tight fold have produced trouble free seams as compared to the usual method of folding by mallet or air hammer. This method can be used on round or rectangular ducts of gages and sizes to cover practically all ducts in the largest fan system.

By permission this article has been abstracted from a paper presented by the author in a symposium on high velocity air distribution at the 62nd annual meeting of the American Society of Heating and Air-Conditioning Engineers in Cincinnati last year. Parts of the paper were published in the April 1956 HPAC Journal Section, pp. 145-146. Later, with other symposium abstracts, the paper accompanied by illustrations was published by ASHAE in a booklet titled "High Velocity Air Distribution." (Single Copy $1.50)


PRESSURE ADJUSTING POINT
FEED METAL HERE
SWAGE ROLLS

2 SWAGE ROLLS, retrieved from the days of the old water well casings or tubing, are now proving useful in construction of air conditioning ducts. They obviate the need for crimping and the attendant troubles of air leakage as well as obstruction to air movement in the joining of round ducts. These rolls swage the metal out at the joint, as shown in the lower diagram, to allow a smooth interior surface as well as a rigid connection. It is necessary to clip the part of the Pittsburgh seam on the male section and to spot emboss in order to allow taping without the use of sealants. By this method and the use of spot welders or tack welding, prefabricated sections up to 25 ft long can be made up without fear of damage prior to installation.


SEAM TO BE PRESSURE ROLLED TO PREVENT LEAKING
ENLARGE ONE END OF DUCT BY ROLLERS TO FIT O D OF MATING DUCT
1"
AIR FLOW
A
1"
2"
DETAIL - A
ADHESIVE ALUM. FOIL TAPE OR EQUIV. TWO WIDTHS REQ'D

3 AIRTIGHT SWAGED JOINT was obtained by applying two layers of tape — one layer 1 in. wide, and a reinforcing layer 2 in. wide — over the initial tape. Numerous types of tape were experimented with, but the most satisfactory was an aluminum tape of high adhesive qualities that had a malleable characteristic to conform to the uneven nature of the joint, there being one thickness of metal difference in section elevation. The tape was worked into the voids by means of soft wood paddle sticks and smoothed on to a clean surface. In this way, pressures in excess of 20 in. WG were satisfactorily held without any additional adhesives. Pliable elastic adhesive tapes were found not to adhere tightly enough over voids particularly at the Pittsburgh seams to prevent leakage at the high pressures unless additional sealants were applied. ‡

The object of the Society is to advance the arts and sciences of heating, ventilating, cooling and air conditioning, and the allied arts and sciences, for the benefit of the general public, to encourage and conduct scientific research, and to cooperate with other organizations having the same or similar objectives.

Heating, Piping & Air Conditioning

Journal Section

of the

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

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SOCIETY COMMITTEE ORGANIZATION

General Committees: The By-Laws provide for 9 such committees. The listing appears in the May 1957 issue on page 174

Research Committees: The research program is under the guidance of the Committee on Research — a General Committee. The Committee on Research appoints Technical Advisory Committees as needed. Latest list, with current membership, appears in the June 1957 issue on page 182

Special Committees: At present there are 9 of these committees. The list of them and of their personnel can be found in the May 1957 issue on page 174

Nominating Committee: This committee's membership is fixed by the By-Laws. The listing appears in the May 1957 issue on page 174

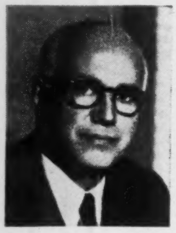
SOCIETY REGIONAL ORGANIZATION

The latest listing of the names of the Regional Directors and of the members of the Chapters Regional Committees appears in the April 1957 issue on page 176

SOCIETY CHAPTERS AND BRANCHES

The Society has chartered 67 Chapters, 1 Special Branch, and 6 Student Branches. These groups elect their officers and governing boards. A list of the presidents and secretaries appears in this issue on pages 181-182

The President's Page



Council Actions at New Orleans Meeting

THE Council of the Society held its spring meeting at New Orleans on Saturday, May 4. On the days preceding the Council meeting, Region 5 held its Chapters Regional Committee meeting on Thursday, May 2, with many Council members in attendance, and on Friday the several Council Committees had their meetings.

You may be interested to learn about some of the Council actions resulting from this Council meeting.

Membership Grades: The Charter and By-Laws Committee, in cooperation with the Executive Committee, has prepared a proposed change to Article II of the By-Laws. If approved by the Society as a By-Laws amendment, this change will revise the current method of electing and conferring the grades of Honorary Member and Fellow. The change requires favorable action at the June Council Meeting before submitting this revision to the members of the Society.

International Institute of Refrigeration: Council has approved participation by the Society in the activities of the U. S. National Committee for the *International Institute of Refrigeration (IIR)*. This committee is an agency set up to assist the *National Academy of Sciences-National Research Council (NAS-NRC)* as the official representative for the United States of America in the *International Institute of Refrigeration.*

The *IIR* is an intergovernmental body established in 1920 and organized to promote the production and utilization of refrigeration on an international scale by means of scientific, technical and economic researches, promotion of refrigeration knowledge and the publication of papers and documents.

The U. S. National Committee to assist the *NAS-NRC* in these matters will include representatives from the *Refrigeration Research Foundation, American Physical Society, American Chemical Society, American Institute of Biological Sciences, ASRE, ASME, AIChE,* as well as the ASHAE. Other agencies to be represented on this Committee are the U. S. Department of Agriculture, Department of Commerce and the Department of the Interior, as well as several representatives at large.

Council Committees: Council directed the Charter and By-Laws Committee to develop a new by-laws change that will enlarge the Council Committees beyond their present three-man size.

Council believes that this change will help relieve the work load on these present three-man committees, a work load that has resulted from the growth of the Society.

New Chapters: Council approved the granting of a charter to a chapter to be established at Johnstown, Pa., and it is planned to have the charter presentation early in September.

Annual Meetings: Council has decided that February and Chicago are to be the time and place for the 1961 Annual Meeting and the 1961 Exposition.

The Program and Papers Committee submitted its tentative program for the 1958 Annual Meeting to be held at Pittsburgh. This tentative program includes four technical sessions and three symposium meetings. The symposium meetings were suggested to cover the subjects of High Temperature Hot Water, Aircraft Air Conditioning, and Schoolhouse Heating, Ventilating and Air Conditioning.

Research: Council approved that a Society contract be set up with the United States Navy for a study at the Society's Laboratory of the problems of noise and attenuation in ducts and duct fittings.

P. B. Gordon
President
AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

Criteria for Room Noise from Air Conditioning

By Carlyle M. Ashley*, Syracuse, N. Y.

THERE CAN be little doubt about the importance of improved noise control in air-conditioning systems after the surveys of consumer reactions made by DuPont for room air-conditioning units and home air-conditioning systems, and by the *Architectural Forum* for all types of systems. But, many people doubt whether any objective criterion can be set up, which can serve as a standard to distinguish between a satisfactory and an unsatisfactory noise condition. This view has been reinforced by the variation of noise tolerance between individuals and under different surroundings, and the difficulty of simulating the range of auditory response by objective means.

Several criteria have been proposed. These criteria have been based upon the evaluation of different properties of sound, including noise level[1], loudness[2], loudness level[3], speech communication[4], and annoyance[5]. In the 1957 edition of THE GUIDE[6] and in the January 1957 issue of *Noise Control*[7], Dr. Leo L. Beranek has presented 2 related criteria, which he has called *noise criteria* (Figs. 1 and 2). These criteria combine a speech communication criterion and a loudness level criterion. Dr. Beranek cites a substantial amount of background experience in human reactions to noise in support of the *criteria* as a means of predicting acceptable and unacceptable noise situations.

The plan in this paper is to consider the characteristics of noise which make it acceptable or unacceptable, examine the *noise criteria* further, suggest a simplified criterion and a more refined method for the evaluation of *quality* of noise.

SUMMARY — Characteristics of noise which make it acceptable or unacceptable are considered; the noise criteria concept is examined and discussed; a simplified criterion for air-conditioning noise is suggested as is a refined method for the evaluation of the quality of noise.

Characteristics of Noise vs. Acceptability

The acceptable amount of air-conditioning noise varies greatly, depending upon the use of the space.

Music: A very low noise level can be tolerated where music or speech is to be reproduced, to avoid having the noise obtrude into the dynamic range of the music. The requirements are only slightly less exacting where music is to be played live, as in auditoriums, churches, music rooms and home living rooms.

Speech Communication: Speech communication is an important requirement of most room uses. But, the background noise level which can be tolerated varies greatly with different applications, depending upon the distance between the speaker and the listener, the acoustical characteristics of the room, and the degree of facility of communication required.

The frequency range which is important to speech intelligibility is from approximately 300 to 5000 cps[8]. The dynamic range between the soft and loud parts of speech is about 30 db, and the variation of the peak level between a soft and very loud voice is approximately 18 db.

When the lower end of the dynamic range of the speech sound drops below the background level, the intelligibility is decreased, and the amount of this decrease depends upon the portion of the dynamic range, which is masked out by the background noise. Additionally, speech intelligibility is limited by the sustained reverberation of the speaker's own voice from the preceding syllables. The effect on speech intelligibility is the result of the addition of background noise and the reverberant speech noise.

Calculations of the reverberant speech level have been made for a number of sizes of rooms with the speaker and listener near opposite ends of the room, according to the method of Bolt and McDonald[9].

These computations involve estimating the differential directivity factor of the speech sound and adjusting the acoustical characteristics of the room to provide very good speech communication with normal speech intensity, (reverberant level, 25 db below speech level peaks). The levels shown in Fig. 3, are the arithmetic mean of the 3 octave bands between 600 and 4800 cps, which is also the basis used for the *speech communication criterion.*

The large rooms shown on this ideal curve are from practical experience too *dead*. The dashed line gives the values for a room having a maximum recommended sound absorption for speaking. It also assumes that the speaker will slow down his speaking, so as to minimize the effect of the reverberant speech level on intelligibility.

Also shown on this figure is the octave band reverberant speech power level. It is especially significant that the power level remains constant, regardless of the size of the room.

If the background noise including the air-conditioning noise is kept at the same level as that of the reverberant speech sound, the articulation index will be decreased only about 10 percent, and the speech intelligibility will still be very good. Assuming that the noise from other sources can be neglected, the corresponding permissible sound power level of the air-conditioning equipment will be the reverberant speech power level corrected for the direct component of the air-conditioning noise at the listener position, that is,

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*Chief Staff Engineer, Carrier Corporation, Member of ASHAE.

[1] Exponent Numerals refer to References.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 1957.

$$L'_w = L_w - 10 \log_{10} [(QR/16 \pi r^2) + 1] \quad \ldots\ldots\ldots\ldots (1)$$

where

L'_w = mean octave band power level from the air-conditioning equipment, 600-4800 cps.

L_w = mean octave band power level equal to the reverberant speech power level for 600 to 4800 cps.

Q = directivity factor.

R = room absorption constant.

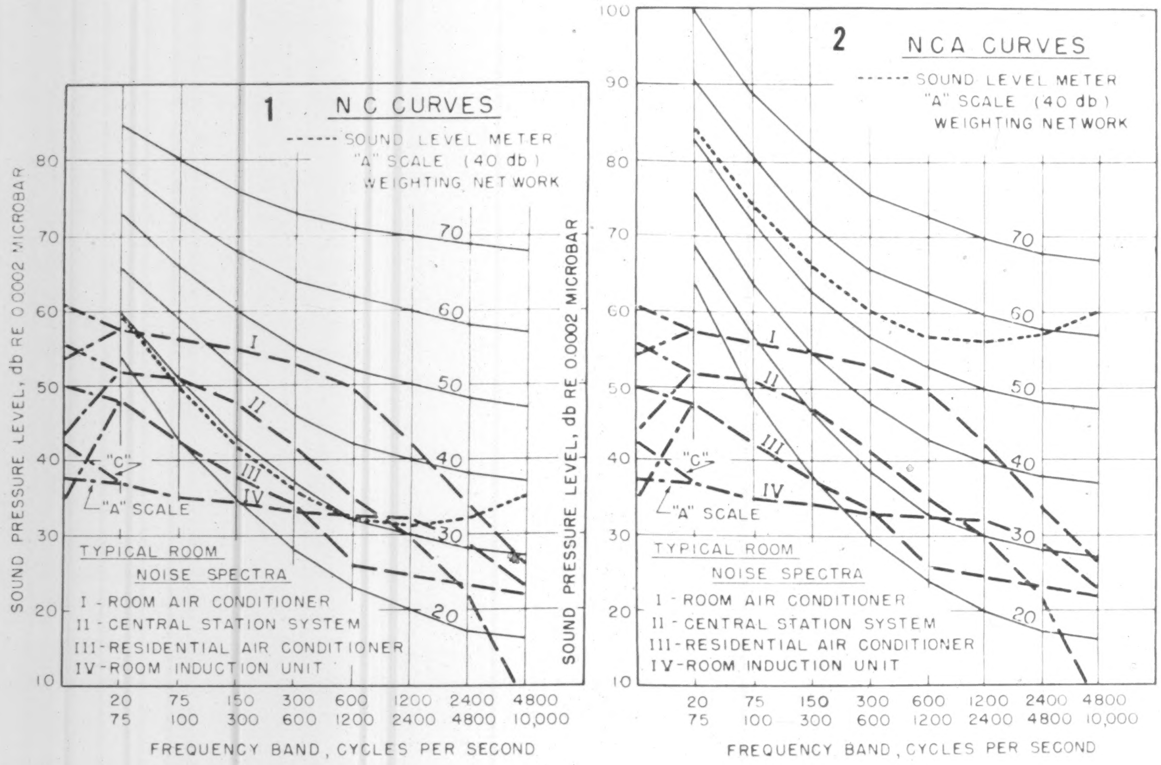
r = distance from the noise source to the listener.

The power level data, Fig. 3, have been expanded in Fig. 4 to show the effects of speaking at different levels and with different degrees of speech intelligibility. This provides a new basis for specifying the amount of permissible noise.

With Fig 4, it should be possible to make a good prediction of the permissible sound power level of air-conditioning noise for such rooms as offices, living rooms, conference rooms, school rooms and theaters in which a single individual is speaking at a time; the interfering noise is relatively unimportant, and the listener may be at the opposite end of the room from the speaker. These data are not suitable for use where music is to be reproduced, since this will require a lower sound power level of the noise. Nor are they suitable for use in stores, restaurants, general offices or other rooms where a number of people may be talking at once, or where there is a high level of noise due to other sources. In this kind of an environment, it is generally neither possible nor desirable to hear speech at any great distance from the speaker, and the direct speech levels as shown by Dr. Beranek are governing[10].

Quality: If the low frequency end of the air-conditioning noise spectrum has a high level, the noise may be annoyingly loud without appreciably affecting speech communication. This loudness can be evaluated in terms of loudness level or in terms of noise level.

If the noise contains audible single-frequency components, its *quality* is greatly reduced, and the annoyance increased. When a noise is intermittent or varies in loudness, it can be extremely annoying — whether the variation is in the form



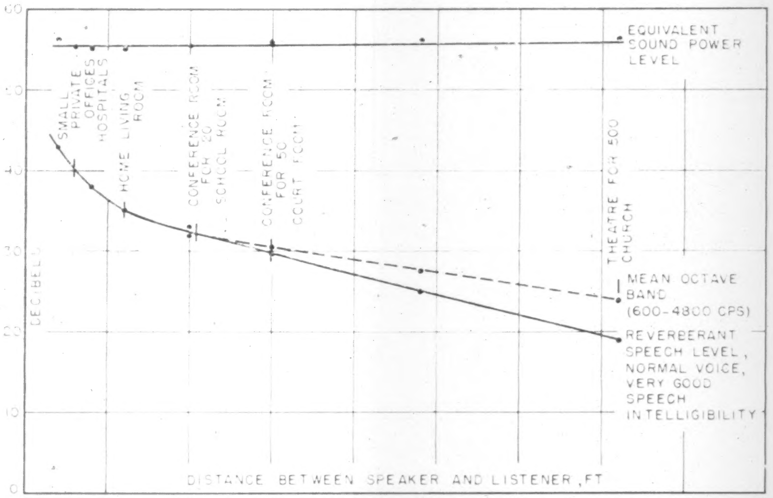
The noise criterion for a given noise spectrum is the highest octave band value of the spectrum.
Example: **Noise spectrum No. I has a NC value of 48 db, from the peak in the fourth octave band.**

The dotted lines show the frequency weighting of the "A" scale (40 db weighting network of the sound level meter). These are compared with the NC-30 and the NCA-55 curves.

Fig. 1 (*left*) and Fig. 2 (*right*)—Noise criteria curves showing typical room noise spectra

of a beat, a turbulent noise, a mechanical rattle or tap. Even broad band noise can be annoying if it has a distinctive frequency characteristic, such as a hiss or a roar.

Conversely, a noise which has no identifiable frequency characteristic or time variation is much less annoying, and a higher loudness level can be tolerated. Such a good *quality* noise is sometimes of value in helping to mask poor quality environmental noise.



The listener is assumed to be close to the opposite end of the room from the speaker. The room has been designed for very good speech intelligibility.
Equivalent sound power level is calculated from the reverberant speech level using the equation:

$$L_w = L_p + 10 \log_{10} \frac{R}{4}$$

Fig. 3—Sound pressure level and the equivalent sound power level due to the reverberant effect of speech in rooms of various size

Noise Criteria

Plotted on the NC curve of Fig. 1, and the NCA curve of Fig. 2 are a number of rather typical noise spectra for air-conditioning noise, and also, the response of the "A" weighting networks of the sound level meter. The value for any particular noise spectrum is the maximum octave band value of the noise criterion reached by a given noise spectrum. The NC criterion of Fig. 1 is intended to be used for relatively quiet and exacting room requirements, whereas the NCA criterion of Fig. 2 is intended to be used in the more noisy environments, or where the quality and speech communication requirements are less exacting.

Not only are these criteria based upon a large number of correlations of acceptability with noise characteristics, but they have also been checked out for a number of trouble jobs, under controlled noise conditions. The author believes that these criteria form a very good basis for the establishment of standards of acceptability. However, there are at least 3 respects in which the criteria leave something to be desired.

First, they do not evaluate fully the effects of poor *quality* noise. The effect of a single-frequency noise, particularly if it has a frequency above 200 to 300 cycles per second, is not adequately identified. In addition, the effect of a time variable noise is not fully identified.

The second problem is which of the 2 charts to select for a given problem and the possible need for interpolation between them. It would be better if it were possible to present a single criterion, although in any case, one must recognize the need for some range in the choice of job quality.

The third possible objection to these criteria is the need for analyzing on the basis of octave bands. The author is fully in agreement with the importance of the use of the octave band analyzer as an analytical and design tool, but it seems obvious that noise standards would be more readily acceptable if they required less measuring equipment, and simpler measuring techniques.

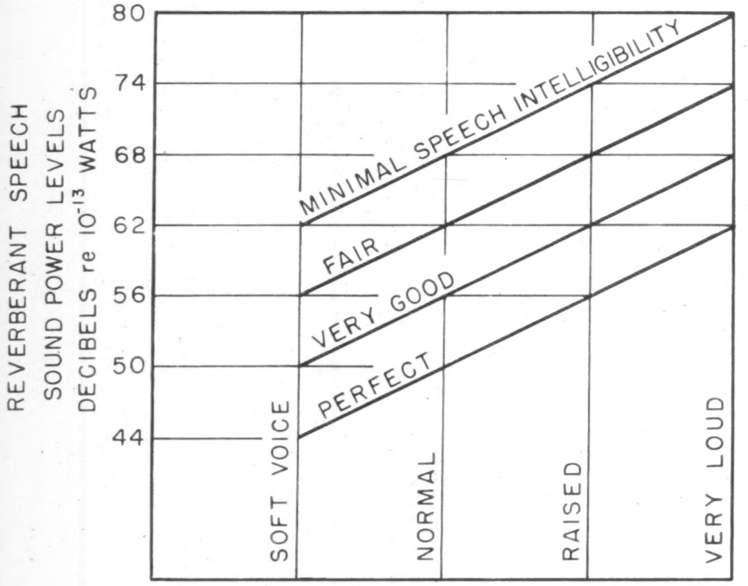
Noise Level as a Criterion: On Fig. 1, the shape of the equivalent "A" scale or 40 db network response of the sound level meter is plotted at the NC-30 line, and on Fig. 2 at the NCA-55 line. It is significant that the low-frequency portion of the "A" scale reading corresponds very closely to the shape of the NC and the NCA curves, respectively. At the high frequency end, the air-conditioning noise is normally not significant. Therefore, the deviation from the curve at this point is usually of no great importance. It is also of significance that the levels at which the "A" scale reading and the *criteria* curves correspond are approximately those levels at which the 2 *criteria* are most frequently recommended for use.

It is evident from Figs. 1 and 2 that air-conditioning noise typically tends to follow more or less the shape of the *criteria* and "A" scale lines. If the octave band spectrum of the noise followed the noise criteria curve very closely, it would be expected that the "A" scale reading would be approximately 10 db higher than the corresponding criterion because of the addition of noise from the 8 octave bands. On the other hand, if the noise spectrum followed the noise criterion curve very poorly, the "A" scale reading would still be expected to be 5 db higher than the noise criterion due to the effect of the addition of the various octave bands.

Journal Section

A number of different types of sound spectra have been compared as to their noise level and criterion value using the shape of the criterion corresponding to NC-30 and NCA-55. The computed results are plotted in Fig. 5 *vs.* the difference between the "A" and the "C" scale of the sound level meter. It is evident that the range of the noise level values is roughly from 5 to 9 db above the value of the NC type criteria.

The principal objection to use of noise level as a criterion is that it does not distinguish as completely between poorly shaped curves as the *noise criteria*. However, the magnitude of this difference is, at the most, of the order of 4 db. Furthermore, there is a possibility of using the difference between the "A" and the "C" scale of the sound level meter for further interpretation of the loudness level effect, if desired.



The sound power level is a mean octave band value for the 600 to 4800 cps bands.

This figure can be used for determining the permissible air-conditioning noise level by using Equation 1 as illustrated in following example:

Example: **Assume that it is desired to have fair speech intelligibility with a normal voice in a room having a room absorption constant of 400 and with the directivity factor of the noise of 4 and at a distance from the noise source of 6 ft, find the permissible mean octave band power level of the air-conditioning equipment.**

From Fig 4,

$$QR/16\pi R^2 = 1.12 \qquad (1)$$
$$L_w = 62$$
$$L'_w = 62 - 10 \log_{10} 2.12 = 59 \text{ db}$$

This figure is usable only where a single person will be speaking at a distance from the listener in a room without amplification. It also assumes that the sound power in the low frequency bands is not controlling of the design requirements.

Fig. 4—Relationship of reverberant speech sound power level to strength of voice and speech intelligibility (an extension of the data of Fig. 3)

The record of corrected trouble jobs reported by Dr. Beranek was also reviewed. The value of the corrections can be as readily identified by means of the noise level readings as by the *noise criteria* evaluation. Again, the differences between the noise level and *noise criteria* are in the range 5 to 9 db.

It should be strongly emphasized that the use of noise level using the sound level meter is intended only for judgment of the acceptability of the noise in a space. For the purposes of noise rating equipment, for proper system design and for the analysis of the results, the use of sound power level or sound pressure level on an octave band basis is imperative.

Recommended Room Noise Levels and Typical Noise Levels from Air-Conditioning Equipment

Fig. 6 shows the recommended noise levels for rooms based on the use of the "A" scale noise level as a criterion. While these values are generally consistent with the values shown in The Guide 1957 of ASHAE, they have, in some cases, been adjusted according to the information shown in Fig. 3. As has been previously indicated, it is necessary to add 5 to 9 db to the NC values to obtain the equivalent noise level values. This same addition can also be made to the values of the curves in Figs. 3 and 4.

The values shown are intended to be reasonably representative of good practice. It cannot be emphasized too strongly that judgment must be exercised in assigning a value for each specific situation. In general, the noise levels shown are lower than most present day practice, particularly where using unitary type of equipment.

Extensive experience in homes indicates a noise level of 40 db as a desirable maximum, with 30 to 35 db preferred for quiet neighborhoods. Likewise, the desirable noise level for hotels and apartments is 40 db, except in very noisy environments. There is, also, a wealth of experience in office applications, which is embodied in the material presented. There is relatively less experience for such applications as hospitals, court rooms, libraries, school rooms and the like, and it is the author's belief that substantially more field experience should be gathered and the recommended values modified accordingly.

On the right-hand side of Fig. 6 are shown representative room noise levels resulting from various types of air-conditioning equipment. It can be seen that there are types of system or equipment available to handle any room use. But, much of the equipment now in use is not fully acceptable for the noise requirements of the spaces in which they are being used. This is particularly true of room air-conditioning and self-contained units.

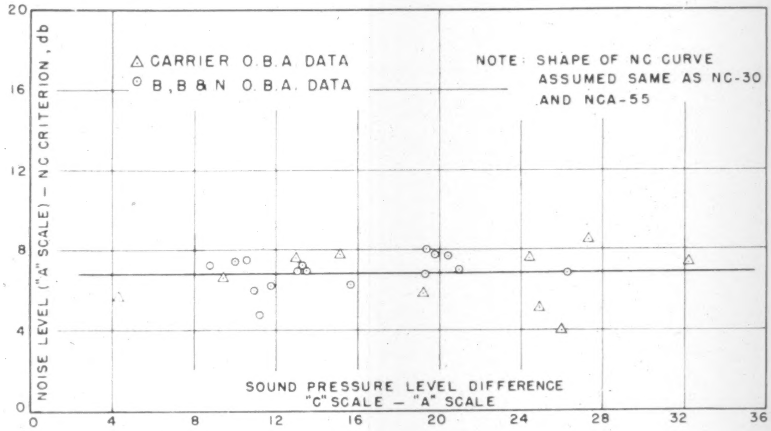
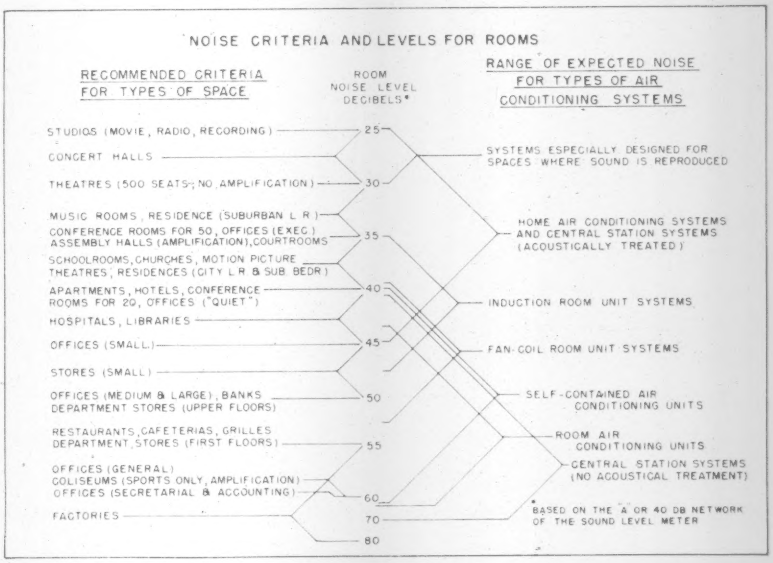


Fig. 5—Comparison of noise level and NC noise criteria for a number of different noise spectra

Evaluating Quality

None of the criteria so far proposed is fully satisfactory in the evaluation of the *quality* of the noise as distinguished from the speech interference and the loudness. It should theoretically be possible to evaluate single-frequency components by measurement with a narrow band analyzer. However, it is not believed that such methods are practical to apply in the field at the present time. It is suggested that consideration be given to applying an additive factor of the order of 5 to 10 db where a single-frequency component is noticeable, the magnitude of the factor to be related to the strength of the single-frequency component.

With respect to judging the effect of variations in noise level, it is believed that a practical, objective tool is available in the form of the *fast* scale of the sound level meter. Maximum and minimum readings should be taken with both the "A" and the "C" scale, and these should then be correlated with subjective observations of noise quality to determine the proper use of the meter for best evaluation. It is believed possible that the maximum reading of the needle may be a good index.


NOISE CRITERIA AND LEVELS FOR ROOMS
RECOMMENDED CRITERIA FOR TYPES OF SPACE
ROOM NOISE LEVEL DECIBELS*
RANGE OF EXPECTED NOISE FOR TYPES OF AIR CONDITIONING SYSTEMS
STUDIOS (MOVIE, RADIO, RECORDING)
CONCERT HALLS
THEATRES (500 SEATS; NO AMPLIFICATION)
MUSIC ROOMS, RESIDENCE (SUBURBAN L R)
CONFERENCE ROOMS FOR 50, OFFICES (EXEC.)
ASSEMBLY HALLS (AMPLIFICATION), COURTROOMS
SCHOOLROOMS, CHURCHES, MOTION PICTURE THEATRES, RESIDENCES (CITY L R & SUB BEDR)
APARTMENTS, HOTELS, CONFERENCE ROOMS FOR 20, OFFICES ("QUIET")
HOSPITALS, LIBRARIES
OFFICES (SMALL)
STORES (SMALL)
OFFICES (MEDIUM & LARGE), BANKS
DEPARTMENT STORES (UPPER FLOORS)
RESTAURANTS, CAFETERIAS, GRILLES
DEPARTMENT STORES (FIRST FLOORS)
OFFICES (GENERAL)
COLISEUMS (SPORTS ONLY, AMPLIFICATION)
OFFICES (SECRETARIAL & ACCOUNTING)
FACTORIES
25
30
35
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60
70
80
SYSTEMS ESPECIALLY DESIGNED FOR SPACES WHERE SOUND IS REPRODUCED
HOME AIR CONDITIONING SYSTEMS AND CENTRAL STATION SYSTEMS (ACOUSTICALLY TREATED)
INDUCTION ROOM UNIT SYSTEMS
FAN-COIL ROOM UNIT SYSTEMS
SELF-CONTAINED AIR CONDITIONING UNITS
ROOM AIR CONDITIONING UNITS
CENTRAL STATION SYSTEMS (NO ACOUSTICAL TREATMENT)
*BASED ON THE "A" OR 40 DB NETWORK OF THE SOUND LEVEL METER

Fig. 6—Noise criteria and levels for rooms

Another approach to the problem of quality is to assume that any job which is noticeably deficient in *quality* needs to have corrective measures. In such cases, the quality criterion would be used, not for quantitative evaluation, but, for purposes of judging the acceptability without respect to noise level. It is evident that the question of *quality* should have further consideration and study.

Field Observations

Fig. 7 shows correlation of octave band measurements, noise criteria and noise level measurements with comments concerning the speech intelligibility. These tests were run in a 14½- × 16-ft office used as a conference room. It is evident that both the *noise criteria* and noise level adequately distinguish between the different degrees of the effect of the room noise. The readings emphasize the relatively small increase in level which can accompany a considerable decrease in speech intelligibility. This important difference may be due in part to the sound source being at one side of the room, thereby creating a condition of unequal noise level distribution in different parts of the room. This situation is typical of many air-conditioned rooms.

Conclusions

The following conclusions can be drawn with respect to noise criteria:

1. It is believed that available criteria form a starting point for establishing standards of acceptable room noise.

2. *Noise level* has been re-examined as a criterion, and has been found to have several advantages and good correlation with other accepted criteria.

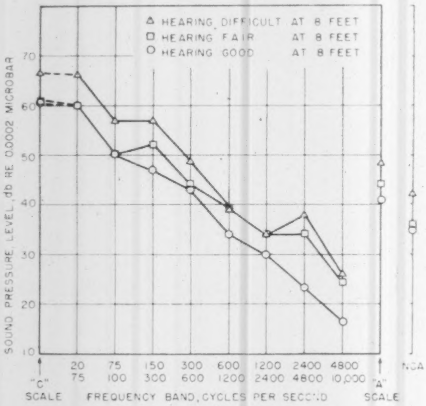

Fig. 7—Spectra of noise, noise level and NCA criteria taken in a small conference room

3. Further information has been presented with respect to the correlation of speech communication with distance in typical rooms.

4. A new method has been presented for determining the sound power level requirements of the air-conditioning noise of certain types of rooms directly, without the necessity of going through sound pressure level.

5. The need for further study has been pointed out, particularly with respect to evaluating the effect of quality of noise having bad characteristics, and for obtaining more field experience on acceptable noise levels for certain types of room uses.

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2. Calculation of the Loudness of Complex Noise, by S. S. Stevens (*Journal of the Acoustical Society of America*, Vol. 28, pp. 807-832, 1956). (This supersedes earlier methods of calculating loudness).

3. The Loudness of Bands of Noise, by Irwin Pollack (*Journal of the Acoustical Society of America*, Vol. 24, 1952, pp. 533-538). *Note*: Portions of these data have previously been presented by Beranek, Peterson, Marshall and Cudworth in the same *Journal*, Vol. 23, 1951, p. 261. (Loudness level of a broad band sound is now computed from loudness. See Ref. 2).

4. *Acoustics*, by L. L. Beranek (McGraw-Hill Book Co., Inc., New York, 1954, pp. 419-429).

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INDUSTRIALIZING THE ATOM

Industrializing the Atom will be the key theme for the 1958 Nuclear Congress now definitely set for March 17-21, 1958, at Chicago's International Amphitheater. With plans well underway, sessions are tentatively scheduled to cover economics, finance, future plans, and much more. Coordinated by the *Engineers Joint Council* for its member societies, managed by the *American Institute of Chemical Engineers*, and sponsored by the engineering and scientific societies interested, the 1958 Congress promises to be bigger than ever. Once again the Hot Laboratories and Equipment Conference, and the National Industrial Conference Board's Atomic Energy in Industry Conference will be part of the 1958 Nuclear Congress.

All engineers and scientists working in the nuclear field are urged to contribute one or more papers. Abstracts are due by June 15, 1957, and authors should get in touch immediately with the Secretary at the Headquarters Office. All papers are being handled by individual societies and not by *EJC*.

In connection with these plans, Pres. P. B. Gordon, New York, N.Y., has announced that H. A. Lockhart, Morton Grove, Ill., is the ASHAE representative on the Nuclear Engineering and Science Conference Committee. President Gordon also has designated W. F. Friend, New York, N.Y., to serve as the ASHAE representative on the General Committee of the Congress.

BOOKLETS ON POST COLLEGE TRAINING

Various industrial and educational groups in the Detroit area have undertaken a community program designed to stimulate the professional development of young engineers. The program is under the sponsorship of the Industry Training Committee, Detroit Area, affiliated with the *Engineers' Council for Professional Development*.

One of the outstanding projects in connection with this is the development of a series of 6 booklets prepared specifically for the project. The nature of the booklets can be judged from their titles as follows: *General and Introductory Booklet*, *Orientation and Training in Industry*, *Appraisal and Counseling on Performance*, *Continued Education*, *Reading List for Engineers*, and *Professional Identification*. These booklets are available from the Engineering Society of Detroit at $2.50 per set, and members interested should write to that society at 100 Farnsworth Avenue, Detroit 2, Mich.

SURVEY INDICATES 75 PERCENT OF N. Y. OFFICES ARE CONDITIONED

A recent survey conducted by the *Office Executives Association of New York* produced evidence that 75 percent of New York offices are air conditioned. Some are completely air conditioned, others are partially so. Most of those without air conditioning are said to be taking steps for installation in the early future.

The survey also indicates that where offices are not air conditioned, many of them make a practice of closing early during hot and humid weather. It appears that a considerable number that do so base the decision to close on a rule of thumb, which is — if the temperature plus 1/5 of the humidity equals 100 or more, the office closes early.

Saturation Pressure of Water on the New Kelvin Temperature Scale

By John A. Goff*, Philadelphia, Pa.

THE SATURATION pressure of water is a thermodynamic property that both the air-conditioning engineer and the meteorologist want to know as accurately as possible. Goff and Gratch[1], in connection with their research under a cooperative agreement between the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS and the University of Pennsylvania, have calculated this property from the very accurate calorimetric data of Osborne, Stimson and Ginnings[2,3] at the National Bureau of Standards, from available spectroscopic data, and from other relevant information regarding water. They have reported their results in the form of empirical formulas that were adopted as standard by the International Meteorological Organization in 1947[4] and by the Joint International Committee on Psychrometric Data in 1949[5]. They have also presented them in tabular form in the HEATING, VENTILATING, AIR CONDITIONING GUIDE[6] for the convenience of the air-conditioning engineer and in Smithsonian Meteorological Tables[7] for that of the meteorologist.

The saturation pressure of water is a pure temperature function. In the empirical formulas just referred to the argument of the function is absolute temperature T^* on the old Kelvin scale with $T_0^* = 273.16$ and $T_1^* = 373.16$ taken from Birge[8] as best values, subject to the stipulation that they differ by exactly 100, for assignment to the ice-point and steam-point isotherms, respectively. In the Smithsonian Meteorological Tables the argument is (thermodynamic) Centigrade temperature, $t^* = T^* - 273.16$, while in THE GUIDE it is the Fahrenheit temperature derived therefrom in the usual manner.

In October 1954 the Tenth General Conference on Weights and Measures[9] adopted a new Kelvin scale T of absolute temperature on which the triple-point isotherm, namely, the locus of states of a given substance in which the substance is in diathermic equilibrium with water in 3 coexisting phases (vapor, liquid, solid), is assigned the value 273.16, exact by convention. The 2 scales deviate by appreciable if small amounts in the range of interest to the air-conditioning engineer and the meteorologist; hence it is desirable to transpose the Goff-Gratch formulas to the new scale T as argument, and the tables, to the new (thermodynamic) Celsius scale, $t = T - 273.15$. This is the object of the present paper.

SUMMARY — By action of the Tenth General Conference on Weights and Measures in October 1954, the Kelvin scale of absolute temperature T was redefined by the exact assignment 273.16 to the triple-point temperature of water. This particular assignment was chosen, after long discussion, as best from the point of view of making the new scale essentially a refinement of the old. The corresponding Celsius scale, $t = T - 273.15$, replaces the old Centigrade scale. The saturation pressure of water is a temperature function that the air-conditioning engineer wants to know as accurately as possible. It is here transposed to the new scales in line with the Society's wish to conform with the recommendations of authoritative standardizing bodies in respect to fundamental definitions and constants. The corrections are significant, but too small to be noticed in ordinary calculations.

The universal temperature function whose existence is asserted by the Second Axiom of thermodynamic theory is called absolute temperature because it has only 1 deg of arbitrariness, a multiplicative constant. This means that only the ratio of the absolute temperatures for assignment to 2 different isotherms can be determined experimentally. This ratio is usually determined by the methods of gas thermometry which, in principle, consist of 2 separate experiments. The first yields compressibility factor, $Z = pv/(pv)^\circ$, as a function of pressure p along each isotherm investigated, $(pv)^\circ$ being the limit that the pressure-volume product pv appears to approach as pressure tends toward zero along the isotherm. Burnett[10] has shown how to avoid volume measurements entirely in this experiment by so designing the apparatus as to place the observed pressures p_r $(r = 1, 2, \ldots)$ at unobserved volumes $v_r = v_0N^r$ in strict geometric progression with unobserved ratio N. The apparatus constant N can be inferred from the pressure sequence p_r as that which makes the quantity N^rp_r appear to approach a finite value $(N^rp_r)^\circ$ as pressure tends toward zero along the given isotherm; then $Z = N^rp_r/(N^rp_r)^\circ$.

The second experiment required for the determination of the ratio of 2 absolute temperatures employs the constant-volume gas thermometer as apparatus. In it the pressure p of a gas whose compressibility factor has previously been determined in the manner just described is measured

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[1] Exponent numerals refer to the References.

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Journal Section

at the unobserved volume v on the T-isotherm, then its pressure p' at the same volume v' $(= v)$ on the T'-isotherm is also measured. With the 2 values of compressibility factor, $Z = Z(p,T)$ and $Z' = Z(p',T')$, known, the ratio of absolute temperatures is computed from $T/T' = pZ'/p'Z$ because this puts absolute temperature directly proportional to the zero-pressure product $(pv)^0$ as required by thermodynamic theory. The important point to note from this brief exposition is that the ratio of absolute temperatures is determinable from measurements of pressure only along the 2 isotherms in question and nowhere below, between, or above.

Adoption of 273.16 for assignment to the triple-point isotherm was accomplished in 2 steps of which an excellent account is given by Stimson[11]. In 1948 The Ninth General Conference on Weights and Measures[12] had decided that the triple-point isotherm was susceptible of practical realization with greater precision than the ice-point isotherm, had recognized the principle of assigning an exact value of absolute temperature to a single fixed-point isotherm which would be the triple-point isotherm, but had left the particular assignment to be chosen later. The choice was not an easy one to make because it was generally agreed that the new scale to be defined by it should be essentially a refinement of the old scale on which the steam-point and ice-point temperatures were made to differ by exactly 100. Thus the chief difficulty came in deciding what is the current best value of the ice-point temperature on the old scale considering the spread of more than 0.02 in the estimates of the various national laboratories. After long discussion in the Advisory Committee on Thermometry and Calorimetry[13] agreement was reached on 273.15 as best value, subject to the stipulated difference of exactly 100 between steam-point and ice-point temperatures, of the ice-point temperature, whereupon 273.16 was recommended to the International Committee on Weights and Measures[14] and subsequently adopted by the Tenth General Conference[9] as previously noted. This body being supreme authority in such matters, one is bound to accept $T_1/T_0 = 373.15/273.15$ as a better value of the ratio of steam-point to ice-point temperature than that previously used, namely, $T_1^*/T_0^* = 373.16/273.16$.

Another method of determining the ratio of 2 absolute temperatures, which is of particular interest here, calls for the experimental determination of (1) the quantity of heat $\gamma(p)$ required to maintain pressure constant during withdrawal of unit weight of saturated vapor from an otherwise adiabatic calorimeter of fixed volume containing a saturated mixture of vapor and liquid water, as a function of the constant pressure p; (2) the compressibility factor $Z_g(p)$ of the saturated vapor as a function of pressure p; (3) the specific volume of water vapor at some conveniently accessible point usually taken on the ice-point isotherm having saturation pressure p_0 not necessarily observed. Osborne, Stimson and Ginnings[2,3] have published remarkably accurate determinations of the calorimetric quantity $\gamma(p)$ closely covering the range from ice-point to steam-point pressure; and from the single determination of specific volume in (4), using the compressibility factor in (2), can be computed the zero-pressure value of the product pv for the ice-point isotherm having saturation pressure p_0 — call it $A(p_0)$. Thus the quantity,

$$P(p) = -A(p_0)\int_1^p (Z_g/p\gamma)\,dp \;\ldots\ldots\ldots (1)$$

is a pure pressure function capable of practical realization with high accuracy; it vanishes, by construction, at a pressure of one standard atmosphere, that is, $P(1) = 0$. The function is important here because, according to thermodynamic theory,

$$T_0/T - T_0/T_1 = P(p), \;\ldots\ldots (2)$$

where

T = temperature on the absolute scale.

T_0 and T_1 = ice-point and steam-point temperatures, respectively.

If p_0 is known, Equation 2 will determine T_1 as soon as a value is assigned to T_0.

Goff and Gratch[1] have used Equation 2 in reverse to calculate saturation pressure p^* as a function of the absolute temperature T^* on the scale with $T^*_0 = 273.16$ and $T^*_1 = 373.16$ after having synthesized the function $P(p)$ from available data. No attempt will be made here to improve the accuracy of $P(p)$ in the light of new experimental findings since any possible improvement is believed to be altogether too slight to justify the effort at this time. No change in $P(p)$ implies that the new and the old scales are related by

$$\frac{T_0}{T} - \frac{T_0}{T_1} = \frac{T_0^*}{T^*} - \frac{T_0^*}{T_1^*} \;\cdots\cdots\cdots (3)$$

which it is convenient to rewrite as

$$\frac{t^* - 100}{t - 100} = \frac{T_0 T_1^* T_1^*}{T_0^* T_1 T_1}\left[1 - \left(\frac{T_0^* T_1}{T_0 T_1^*} - 1\right)\left(\frac{t^* - 100}{T_1^*}\right)\right]$$

with

$t = T - T_0$

$t^* = T^* - T^*_0$

or, after inserting numerical values and rearranging, as

$$\frac{t - t^*}{0.0016988\left(1 - \frac{t^*}{100}\right)} = 1$$

$$+ 0.154754\left(1 - \frac{t^*}{100}\right)$$

$$+ \qquad (4)$$

Thus, the 1946 Goff-Gratch value p_0^* of the ice-point pressure lies at 273.1519617 on the new Kelvin scale so that the new improved value p_0 at 273.15 must be less than p_0^* by amount 0.0019617 $(dp/dT)_0$, approximately. The derivative dp/dT is calculable with requisite accuracy from the Goff-Gratch formulas.

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†The definition of the standard atmosphere (atm), 1 atm = 1013250 dyne/cm², given by the Ninth General Conference on Weights and Measures in defining the International Temperature Scale of 1948 was adopted for all purposes by the Tenth General Conference (see Reference 9).

Saturation with Respect to Liquid, −50 to 100 C

For saturation with respect to liquid the Goff-Gratch formula is of the form, log $p^* = G(T_1^*/T^*)$, and therefore yields the improvement

$$\log P = G + \left(\frac{T_1^*}{T^*}\right)^2\left(\frac{(t-t^*)}{T_1^*}\right)G' \cdots\cdots (5)$$

At $t^* = 0$, for example, compute: $G = -2.2198292$, $G' = -6.310041$, $t - t^* = 0.0019617$, whence log $p_0 = -2.2198911$ and $p_0 = 0.0060271$ atm as against $p^*_0 = 0.0060280$ atm before improvement. The correction $\triangle p$ to be added to the previously tabulated values of p^* as a function of (thermodynamic) Centigrade temperature t^* to give improved values p as a function of (thermodynamic) Celsius temperature t is exhibited graphically in Fig. 1 and numerically in Table 1.

The next step is to amend the formula to contain these corrections. Writing $G(T^*_1/T^*) = G(T_1/T) + (T^*_1/T^* - T_1/T)G' + \ldots$, calculate the coefficient of G' from Equation 3 to be $(T^*_0T_1/T_0T^*_1 - 1)(T^*_1/T^* - 1)$ which is reduced to $(0.01 \times 100/T_0T^*_1)(T^*_1/T^* - 1)$ by inserting $T^*_0 - T_0 = 0.01$ and $T_1 - T_0 = 100$. Values of the increment $\triangle G = (T^*_1/T^* - T_1/T)G'$ were computed at 11 equally spaced values of t^* in the range 0(10)100 deg C and adjusted by the method of least squares to the formula,

$$\begin{aligned}\Delta G = {} & 0.901\times 10^{-4}\left(\frac{T_1}{T}-1\right)\\ & -0.811\times 10^{-4}\log\left(\frac{T_1}{T}\right)\end{aligned}$$

with a root mean square deviation of $\pm 1.6 \times 10^{-8}$. The adjusted increment is an easy one to add to $G(T_1/T)$ after which the argument of G is changed to $T_{01}/T = (T_{01}/T_1)(T_1/T)$. The final result is

$$\begin{aligned}\log p = {} & 10.79574(1-T_{01}/T)\\ & -5.02800\log(T/T_{01})\\ & +1.50475\times 10^{-4}\left(1-10^{-8.2969(T/T_{01}-1)}\right)\\ & +0.42873\times 10^{-3}\left(10^{4.76955(1-T_{01}/T)}-1\right)\\ & -2.2195768 \cdots\cdots (6)\end{aligned}$$

with $T_{01} = 273.16$ and with p expressed in standard atmospheres†. The amended Equation 6 gives $p_{01} = 0.00603147$ atm as triple-point pressure and, as previously noted, $p_0 = 0.0060271$ atm as ice-point pressure. The International Meteorological Organization[4] has recommended that the 1946 formula from which the foregoing has been derived be used for undercooled liquid down to −50 C pending further research.

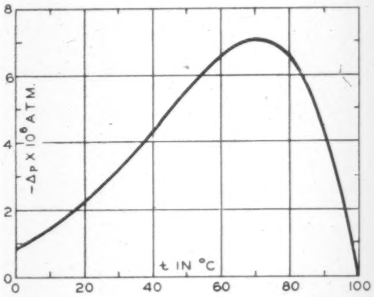

Fig. 1 — Plot of correction Δp from data of Table 1

Table 1 — Correction Δp to be added to 1946 Goff-Gratch values of saturation pressure of water with respect to liquid

t (°C)	$-\Delta p \times 10^3$ (mb)	p (mb)	p (lb/in.²)	$-\Delta p \times 10^4$ (lb/in.²)	(°F)
0	0.85	6.1078	0.088586	0.126	32
10	1.39	12.272	0.17799	0.207	50
20	2.16	23.373	0.33900	0.322	68
30	3.14	42.430	0.61540	0.467	86
40	4.27	73.777	1.0700	0.636	104
50	5.46	123.40	1.7897	0.813	122
60	6.49	199.26	2.8900	0.967	140
70	7.02	311.69	4.5207	1.045	158
80	6.56	473.67	6.8699	0.977	176
90	4.48	701.13	10.169	0.667	194
100	0.00	1013.25	14.6959	0.000	212

Saturation with Respect to Ice

For saturation with respect to ice the Goff-Gratch formula is of the form, log $p^* = F(T^*_0/T^*)$. The first step is to change the argument of the function F to $T^*_{01}/T^* = (T^*_{01}/T^*)(T^*_0/T^*)$ with additive constant $-2.2195136 = \log p^*_{01}$. Then numerical values of the increment, $\triangle F = (T^*_{01}/T^* - T_{01}/T)F'$, were computed at 10 equally spaced values of t in the range −180(20)0 deg C and adjusted by the method of least squares to the formula.

$$\begin{aligned}\Delta F = {} & 0.7015\times 10^{-4}\\ & +0.0288\times 10^{-4}\left(\frac{T_{01}}{T}-1\right)\\ & -0.3419\times 10^{-4}\log\left(\frac{T_{01}}{T}\right)\\ & +0.1313\times 10^{-4}\left(1-\frac{T}{T_{01}}\right)\end{aligned}$$

with a root mean square deviation of $\pm 2.8 \times 10^{-8}$. This is an easy increment to add to $F(T_{01}/T)$ and the final result, after adding 0.0000069 to make the new saturation curve pass through the new triple-point pressure, is

$$\begin{aligned}\log p = {} & -9.096853\left(\frac{T_{01}}{T}-1\right)\\ & -3.566506\log\left(\frac{T_{01}}{T}\right)\\ & +0.876812\left(1-\frac{T}{T_{01}}\right)\\ & -2.2195768 \cdots\cdots (7)\end{aligned}$$

with $T_{01} = 273.16$ and with pressure expressed in standard atmospheres. The amended Equation 7 accepts 0.00603147 atm as triple-point pressure and gives $p_0 = 0.0060265$ atm as ice-point pressure instead of the 0.0060273 atm used by Goff and Gratch[1] in the 1946 formula. The quantity $p^*\log_e(p/p^*)$ calculated from Equation 7 with $T = t + 273.15$ and from the corresponding 1946 formula with $T^* = T + 0.01$ is the correction $\triangle p$ to be added to the previously tabulated values of p^* as a function of t^* to get improved values of p as a function of (thermodynamic) Celsius temperature t. The corresponding relative correction $\triangle p/p$ is exhibited graphically in Fig. 2 and numerically in Table 2.

Summary

The 1946 Goff-Gratch formulas for the saturation pressure of water, which were adopted by the International Meteorological Organization in 1947 and by the International Joint Committee on Psychrometric Data in 1949, have been amended to give improved values of saturation pressure at stated temperatures on the new Kelvin scale adopted by the Tenth General Conference on Weights and Measures in 1954. The amended formulae are being recommended for adoption to the Commission for Aerology, World Meteorological Organization, at its second session which opens in Paris on June 18, 1957, by the Working Group on Physical Functions and Constants of that Commission. The amended formulas are: Equation 6 for saturation with respect to liquid in the range −50 to 100 C; Equation 7 for saturation with respect to ice below 0.01 C, the triple-point temperature on the new (thermodynamic) Celsius scale. Both formulas give 0.00603147 atm (6.1114 millibars) as triple-point pressure; Equation 6 gives 0.0060271 atm (6.1070 millibars) as ice-point pressure at saturation with respect to liquid; Equation 7 gives 0.0060265 atm (6.1064 millibars) as ice-point pressure at saturation with respect to ice.

Skeleton tables of corrections to be applied to the tabular values of saturation pressure as a function of (thermodynamic) centigrade temperature calculated from the 1946 formulas have been prepared to facilitate revision of these tables to make them give improved values of saturation pressure as a function of (thermodynamic) Celsius temperature instead.

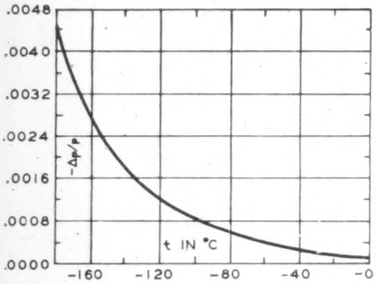

Fig. 2 — Plot of correction $\Delta p/p$ from data of Table 2

Table 2 — Correction $\Delta p/p$ to 1946 Goff-Gratch values of saturation pressure of water with respect to ice

t (°C)	$\Delta p/p$	t (°F)	t (°C)	$\Delta p/p$	t (°F)
−180	−.00469	−292	−80	−.000616	−112
−160	−.00290	−256	−60	−.000431	−76
−140	−.00189	−220	−40	−.000299	−40
−120	−.00128	−184	−20	−.000203	−4
−100	−.000883	−148	−0	−.000132	+32

It may not be inappropriate here to note that Reardon[15] has recently calculated the pseudoadiabats of moist air from the Goff-Gratch formulation[5] transposed to temperatures on the new Kelvin scale.

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NUCLEAR ENGINEERING SESSIONS AT CALIFORNIA

Each year sees more instructional material available concerning nuclear energy. Also, there has been a steady growth in the number of engineering courses offered in that field.

The Engineering and Sciences Extension of the University of California is offering two nuclear engineering programs during the present summer. One of these is the Nuclear Engineering Short Course which will extend for the nine weeks between July 1 and August 30th. The other course is a Nuclear Engineering Survey to be held during the week of July 8-12th. Both these projects are open, and information concerning enrollments can be obtained from the Engineering and Sciences Extension, Nuclear Energy Programs, Room 100, Building T-11, University of California, Berkeley 4, Calif.

AIR POLLUTION DIRECTORY

A recent publication is the Directory of Governmental Air Pollution Agencies. This is a booklet of some 40 pages published by the *Air Pollution Control Association* in cooperation with the Robt. A. Taft Sanitary Engineering Center of the U. S. Public Health Service at Cincinnati.

The book lists state and local governmental agencies responsible for air pollution control in the several states.

The Directory is published for the sole use and convenience of those interested in air pollution and its control, and members who wish to obtain a copy can do so by a request directed to *Air Pollution Control Association*, 4400 Fifth Avenue, Pittsburgh 13, Pa. Request may also be directed to the Robt. A. Taft Sanitary Engineering Center at 4676 Columbia Parkway, Cincinnati 26, Ohio.

Design and Performance of a Portable Infiltration Meter

By Carl W. Coblentz[*] and Paul R. Achenbach[**], Washington, D.C.

SUMMARY — An infiltration meter was designed and constructed for measuring the concentration of a tracer gas in air employing natural convection of the gas mixture through the sensing elements. This design avoids the necessity of a system of sampling tubes and a pump, thus making it more portable than commercial instruments currently available for studying air infiltration in buildings. The instrument is a multiple thermal conductivity meter, or Katharometer, and has 10 sensing elements, or probes, each of which consists of a brass block with thermistors installed in its 2 cylindrical cavities; one hermetically sealed, the other ventilated by the natural convection of the gas mixture caused by the heated thermistor in the cavity. The probes, which may be placed in different rooms, are connected to the measuring cabinet with cables. Separate regulating and bridge circuits for each probe and the control and measuring equipment are assembled in the control cabinet. Infiltration measurements can be made in a building with little inconvenience to the occupants.

Calculation of the heating or cooling load of a structure usually includes a component for the load caused by the infiltration of outside air into the building. The computation of this portion of the heating or cooling load may be based on the length of the cracks around the doors and windows, an estimate of the workmanship involved, the design wind velocity, the degree of exposure to the wind, and the inside-outside temperature difference; or it may be based on a more general estimate of the number of air changes under design conditions. These methods are known to provide only approximations of the true air leakage, but they have been found useful in the absence of an acceptable method for direct measurement of air leakage. A portable infiltration meter was designed and constructed which utilizes the tracer-gas technique to determine the air change rate in different rooms or at different places in a building.

The air change rate of an enclosure is usually defined as the ratio of the hourly rate at which the air enters (or leaves) the enclosure to the volume of the enclosure. The rate of change in concentration of a tracer gas caused by infiltration of outside air can be expressed by the formula:

$$-V\,(dc/dt) = Kc \quad \ldots\ldots\ldots\ldots\ldots(1)$$

where

V = volume of the enclosure.
c = concentration of tracer gas at time t.
K = average volume of air infiltration per unit time for the time interval.

When $c = c_0$ at $t = 0$, the solution of Equation 1 is as follows:

$$c = c_0 \; e^{Kt/V} \quad \ldots\ldots\ldots(2)$$

or

$$Kt/V = \log_e \,(c_0/c) \quad \ldots\ldots\ldots(3)$$

Equation 3 shows that the number of air changes occurring during the time t is equal to the natural logarithm of the ratio of the tracer-gas concentrations at the beginning and at the end of this time interval.

One of the methods for measuring changes in concentration of a tracer gas is to observe the change of thermal conductivity of the mixture of air and the tracer gas. Since the thermal conductivity of helium is about 6 times that of air, small concentrations of helium in air cause a change in the thermal conductivity of the mixture that can readily be measured by means of a thermal conductivity meter. This technique was probably first used by Marley[1] in England for measuring air infiltration of buildings. Other tracer gases and other means of measuring change of concentration of these tracers have been proposed and some are in practical use. Some of these alternate tracer-gas techniques use the following gases and detecting instruments:

1. Ethane gas with an interferometer.
2. Radioactive tracer gas with a sensitive electrometer.
3. Hydrocarbon gas with an infrared gas analyzer.
4. Halogenated hydrocarbon gas with a photometer.
5. Hydrocarbon gas with a sensitive hygrometer to sense changes in the moisture content of samples after combustion of the hydrocarbon.

In designing the portable thermal conductivity meter (Fig. 1), or katharometer, simplification in the apparatus and procedure for making infiltration measurements by the tracer-gas method was sought by applying the following principles:

1. The sensing elements were located in the spaces where the infiltration rate was to be measured, and natural convection moved the mixture of tracer gas and air through them, thus all sensing elements had the same lag in response. The sensing elements were connected to the measuring console with cables.
2. The change in tracer-gas concentration was observed rather than the absolute value since only the change in concentration is required to determine infiltration rate.
3. A saturater was not required for the gas sample since the change of humidity at a given station during a 1-hour infiltration test would usually be small and because absolute values were not being measured.

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For presentation at the Semi-Annual Meeting of the American Society of Heating and Air-Conditioning Engineers, Murray Bay, Que., Canada, June 1957.

[1] The Measurement of the Rate of Air Change, by W. G. Marley (*Journal of the Institution of Heating and Ventilating Engineers*, Vol. 2, 1935).

Journal Section

Although the thermal conductivity of hydrogen is about 7 times that of air, whereas that of helium is only 6 times as high as air, the use of helium is preferable for infiltration measurements because of the explosion hazard of hydrogen. However, when helium is not available, the use of a hydrogen concentration of 0.4 percent does not introduce an acute danger, as the minimum explosive concentration of hydrogen is about 4.1 percent. Hydrogen should not be used when the house is heated with a hot air furnace, since the hydrogen would be slowly oxidized as the hydrogen-laden air was recirculated between the furnace and the living space, and thus introduce a false indication of decay.

Design of the Sensing Elements

The thermal conductivity cells consist of brass blocks $1 \times 1\frac{3}{4} \times 3\frac{1}{4}$ in. with two $\frac{5}{8}$-in. ID cylindrical cavities, symmetrically arranged. Carefully matched thermistors, of the bead type on a glass probe, are cemented in the cavities with epoxy-type cement. One cavity is hermetically sealed and the other one contains two 3/64-in. holes each at the top and at the bottom of the cavity to permit natural convection air movement, induced by the heated thermistor. The 2 thermistors are connected in series and are heated with 120 milliwatts to approximately 200 F. This heat input produces a rise in temperature of the brass blocks of less than 1 deg above room temperature. The time constant for the response of the sensing elements was found to be about 76 sec.

Both cavities provide equivalent heat absorbing surfaces. The coefficients of heat transfer by radiation and convection are the same for both cavities, whereas the coefficient of heat transfer by conduction is higher in the cavity which contains the helium-air mixture. Therefore, the thermistor in this cavity will be slightly cooler than the one in the sealed cavity. Small changes in the temperature of the thermistor produce a considerable change of its resistance, such that a change of helium concentration can be determined by observing the difference of the resistance of the 2 thermistors. By installing the 2 thermistors in a Wheatstone bridge circuit, the unbalance produced by presence of helium in 1 cavity can be used as a measure of helium concentration.

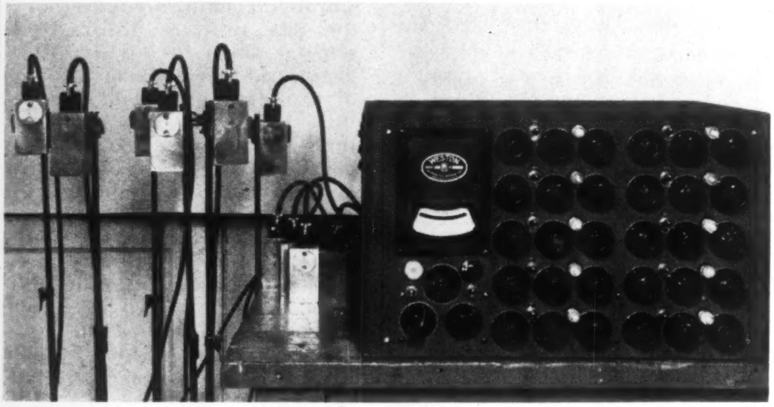

Fig. 1 — View of the newly designed portable infiltration meter

Design of the Measuring Apparatus

The control cabinet housed the bridge circuits and control equipment for 10 sensing elements and was designed for 115-volt a-c operation. Each probe had a polarized outlet and was connected with the cabinet by means of a 3-conductor shielded cable. A schematic wiring diagram of the apparatus showing the power supply and metering circuit and one of the 10 probe circuits is shown in Fig. 2. Two 200-ohm resistors, R_3 and R_5, formed the fixed legs of the Wheatstone bridge for each test probe. Each bridge circuit was balanced with two 10-ohm variable resistors, R_4 and R_6, connected in parallel. One of them, R_4, was connected in series with the fixed 10-ohm resistor, R_7, to provide a coarse and fine adjustment over a rather wide range.

The thermistors in each probe were selected to have a minimum difference in resistance over a current range from 12 MA to 22 MA. However, it was found that due to the aging of the thermistors and resistors, and to the accumulation of certain gases produced by the setting of the cement in the sealed cavity, an appreciable balancing range was necessary for the bridge circuit.

A filtered 105-volt direct current supply for each probe circuit was obtained by installing a variable transformer in series with the a-c side of a full-wave selenium rectifier. This variable transformer also compensates for aging of the rectifier and for changes in the output voltage caused by using different numbers of probes.

A constant-wattage network is required for supplying the thermistors. Line voltage fluctuations were reduced by means of a voltage regulator tube, VR-OA3, with a variable resistance tube D6-FT39, as the voltage-dropping resistor. With a proper variable resistor, R_2, and a switchboard bulb, T2-48, operating as pilot light as well as a voltage-dropping resistor, as shown in Fig. 2, fluctuations of the a-c supply voltage of ±25 percent produce a change in the bridge heater current of less than 0.4 percent. The individual current control for each bridge circuit is necessary because the thermistors require a higher initial voltage to bring them up to temperature.

A 1040-ohm microammeter, M, with full scale deflection at 5 microampere current is used as an indicator. Two series-connected selector switches and the necessary shunt and voltage-dropping resistors permit the measurement of the progressive unbalance of the Wheatstone bridge circuit of each probe, the heating current of each probe, the d-c output voltage of the rectifier, and allow shunting of the meter when not in operation. A green pilot light indicates that the line voltage is supplied to the variable transformer and a red pilot light shows that the 2-megohm safety resistor, R_8, in series with the indicating meter, has been shunted.

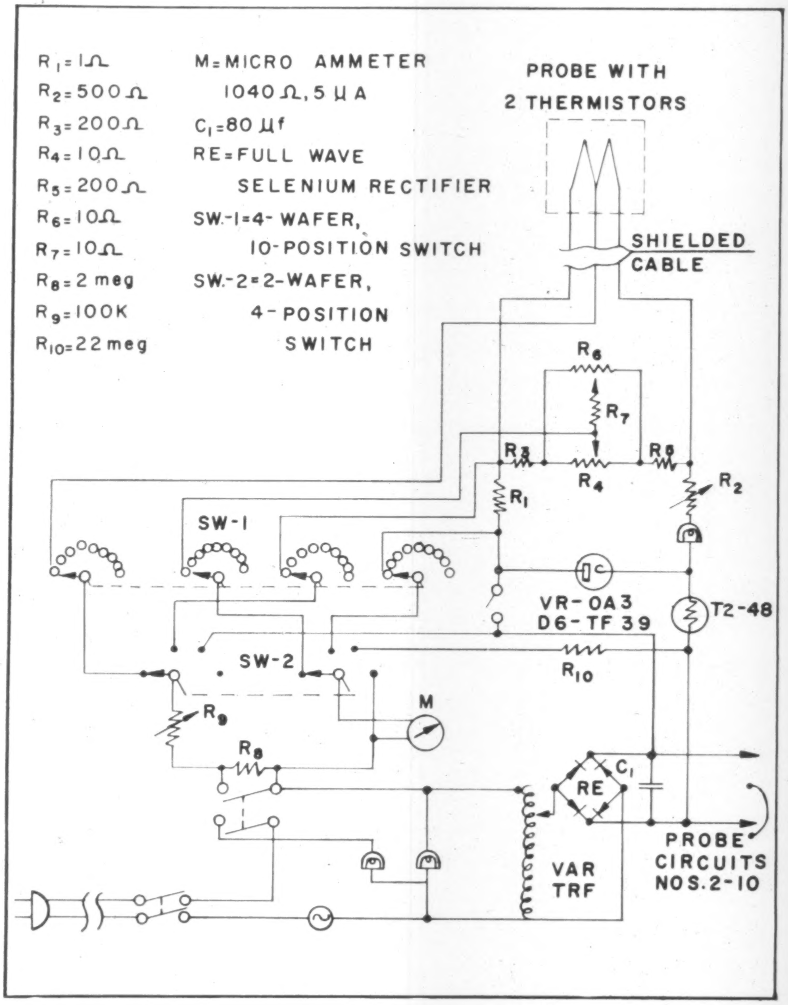
R1=1Ω
R2=500Ω
R3=200Ω
R4=10Ω
R5=200Ω
R6=10Ω
R7=10Ω
R8=2 meg
R9=100K
R10=22 meg
M=MICRO AMMETER 1040Ω, 5 μA
C1=80 μf
RE=FULL WAVE SELENIUM RECTIFIER
SW.-1=4-WAFER, 10-POSITION SWITCH
SW.-2=2-WAFER, 4-POSITION SWITCH
PROBE WITH 2 THERMISTORS
SHIELDED CABLE
R6
R7
R3
R5
R4
R1
R2
SW-1
C
VR-OA3
D6-TF 39
T2-48
SW-2
R10
R9
M
R8
C1
RE
PROBE CIRCUITS NOS.2-10
VAR TRF

Fig. 2 — Schematic wiring diagram of power supply, the metering circuit and one of the probe circuits

Performance

When air infiltrates into a room at a steady rate, the tracer-gas concentration decreases along a logarithmic curve as shown by Equation 3. Plotted on semi-logarithmic paper the decay curve, then, must be a straight line. A test was made under controlled conditions in the Test Bungalow at the National Bureau of Standards where the outside air movement and inside and outside temperatures were maintained constant. Under such steady conditions the forces producing infiltration should be constant and the rate of air leakage should also be constant. Observations were made on both the portable infiltration meter described herein and a larger commercial helium indicator which employed a sampling system and a pump. The inlet of the sampling line of the commercial instrument was installed adjacent to the probe of the portable meter and the first readings of both instruments were taken at the same time. The observed readings for both instruments are plotted in Fig. 3. The straight lines shown are those best fitted to the observed data based on the least mean squares of the deviations. The straight lines show that both instruments were indicating a logarithmic decay in the helium concentration. The infiltration rate indicated in Fig. 3 by the commercial instrument is 3.23 air changes per hour, whereas that indicated by the portable infiltration meter is 3.19 air changes per hour.

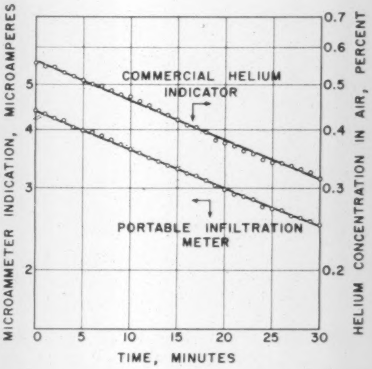

Fig. 3 — Decay curves of portable infiltration meter and commercial helium indicator

The effect of a change in relative humidity around the sensing probe was determined by measuring the change in the microammeter indication for a known change in relative humidity. For this purpose a probe was allowed to come to steady-state conditions with no helium in the air for an ambient relative humidity of 28 percent. The probe was then placed in a sealed can into which an ample amount of calcium chloride crystals had been placed to reduce the relative humidity to approximately 0.5 percent. The microammeter showed a change in deflection of 0.20 microamperes, indicating a higher infiltration rate than the true value. It subsequently returned to its original position after removing the desiccant and admitting room air into the can.

On the basis of this test, the error in the computed air-change rate caused by a 1 percent change in relative humidity during a 1-hr test period when the apparent infiltration rate was 1 air change per hr and the initial helium concentration caused a 5.0 microampere scale deflection would be 0.4 percent. The error in computed infiltration rate caused by a unit change in relative humidity should increase with temperature and with decreasing infiltration rate, but would probably be very little affected by the relative humidity level.

A change in the room temperature during the test period would have no effect on the meter reading, if the 2 thermistors in a probe were perfectly matched with respect to their temperature-resistance characteristics over the range of temperature used. Moderate care, but not the ultimate possible, was used in matching the thermistors for the prototype instrument. A test of one of the sensing probes showed that a deflection of 0.35 μA was caused on the indicating meter by a temperature change of 35 deg, *i.e.*, the sensitivity to temperature was 0.01 μA/F.

Under the same test conditions cited for the investigation of sensitivity to relative humidity, the error caused by a 1 deg temperature change would be 0.3 percent. Logically, a standard for matching the thermistors would have to be established if the prototype infiltration meter were put into commercial production.

Operational Procedure

For infiltration measurements, the console is placed at a central location in the building and a probe is mounted on a tripod near the middle of each room about 3 ft above the floor. After adjusting the heating current for each probe, at least a ½-hr period should be allowed for all components to warm up to a steady state condition. The bridge circuits are then balanced by adjusting the balancing resistors so that the meter reads zero for each probe used in the test. Helium in the amount of approximately ½ of 1 percent of the total volume of the space is then introduced either directly into the rooms and thoroughly mixed with the room air by using desk-type fans or, where a forced air heating system is in use, the helium is fed into the blower intake and distributed into the rooms through the duct system.

Under some conditions of usage of the infiltration meter, the corrections required to account for changing ambient humidity and temperature during a test could be determined by observing the drift of the microammeter during a rating period preceding the introduction of helium into the space. This method would probably be useful only when the changes in humidity and temperature followed a steady trend during the rating period and the test period.

The apparatus described can be used to study air movement between the different enclosed spaces in a house, such as basement and living quarters, first floor and second floor, living quarters and attic, or between outdoors and any of these spaces. It is sufficiently portable to use in field studies of infiltration in different types of building construction without great inconvenience to the occupants of the building.

STANDARD FOR RATING EQUIPMENT NOISE

A joint standard on rating and testing air-conditioning equipment with respect to noise is to be prepared jointly by *ASRE* and ASHAE. Some of the equipment that will be considered will be: (1) fans connected to duct work; (2) small and medium size equipment located within air-conditioned rooms; (3) large refrigeration equipment; (4) terminal devices, such as outlets, damper, sound absorber grilles, and induction units; (5) air-conditioning equipment attached to duct work; and (6) self-contained equipment, such as room air conditioners.

ASHAE representatives on this committee are: Carlyle M. Ashley, R. D. Madison and A. F. Hubbard.

REVIEW FOR PROPOSED AIR MOVERS CODE

K. T. Davis, chairman of the Society Standards Committee, has appointed Profs. S. Konzo, University of Illinois; G. L. Tuve, Case Institute of Technology; and L. G. Seigel, Gannon College; and D. D. Wile, Refrigeration Engineering, Inc., as a review committee for a Proposed Standard Test Code for Air Moving Devices. This proposed code is a revision of the former Standard Test Code for Centrifugal and Axial Fans, originally prepared by the *National Association of Fan Manufacturers* and the Society. The revision was prepared by the Engineering Committee of the *Air Moving and Conditioning Association*. The review committee will determine the suitability of the revised code for Society sponsorship.

SOLAR HOUSE PLANNED FOR TUCSON

It is reported that a house — solar heated in winter and cooled in summer by radiation to the night sky — is to be constructed in Tucson, Ariz. The proposed house is to be partially financed by the University and State College of Arizona and will house the solar radiation equipment of the University Institute of Atmospheric Physics. If announced plans carry through, it is expected that the construction of the house will be started during the present summer.

WARM AIR TECHNICAL CONFERENCE

The second technical conference of the *National Warm Air Heating and Air Conditioning Association* was held at the Hotel Cleveland in Cleveland, Ohio, on May 1-2. There were four technical sessions and the following members of the Society presented papers or discussed assigned topics: F. J. Nunlist, Jr., Milwaukee, Wis.; F. L. Meyer, Peoria, Ill.; R. J. Waalkes, Holland, Mich.; R. A. Gonzalez, Dayton, Ohio; Prof. S. Konzo, Urbana, Ill.; A. B. Newton, Wichita, Kans.; D. R. Bahnfleth, Urbana, Ill.; and G. F. Landgraf, McKees Rocks, Pa.

Measurement of Infiltration in Two Residences

Part II: Comparison of Variables Affecting Infiltration

By D. R. Bahnfleth*, T. D. Moseley** and W. S. Harris†, Urbana, Ill.

This paper is the result of research sponsored by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS in cooperation with the University of Illinois, Urbana, Ill.

SUMMARY: Infiltration in residences is caused by the simultaneous action of pressure differences caused by wind and temperature differences. The effect that these variables had on the infiltration in the I=B=R Research Home and Warm Air Heating Research Residence No. 2, two experimental houses at the University of Illinois, is discussed in this part of this paper. Infiltration rates were measured by means of the helium tracer gas method. The heating plant chimneys had an observable effect on the infiltration in the 2 houses; the effect was more pronounced in the 2-story Research Home. The measured infiltration rates were compared to design rates calculated by the *crack* and *air change* methods, and good agreement was obtained. However, there is no assurance of good agreement had the houses been located in other climates.

INFILTRATION measured in the I=B=R Research Home and Warm Air Heating Research Residence No. 2 by the helium tracer gas method and the weather conditions under which the measurements were made were presented[1] in Part I of this paper. The Research Home was a 2-story brick veneer house with full basement, located on a typical city site surrounded by houses and trees. Research Residence No. 2 was a single-story frame structure with full basement, and located on an open site typical of many new housing developments. Differences in location and construction of the 2 houses caused several noticeable differences in the results of the 2 investigations. The objective of this part of the paper is to compare the effects of the variables related to infiltration in the individual houses and to compare the results for the 2 houses.

Since the measured data were obtained over a range of combinations of wind velocity and direction, and indoor-outdoor temperature difference, and since only a limited number of tests were conducted in each house, it was deemed advisable to correct the measured data to specific conditions of wind and temperature difference. The corrections to the original data were determined from the slopes of plots of the original data assuming in all cases that a straight-line relationship existed between the dependent and independent variables. For example, the average increase in infiltration with each mph increase of wind velocity was obtained from a plot of air change rate as a function of wind velocity. This incremental change was used to correct the measured air change rates to conditions of 0, 7.5 and 15.0 mph winds. The corrected air change rates were plotted as a function of indoor-outdoor temperature difference and the new curves of air change *vs.* temperature difference were used to obtain correction factors for temperature difference. The corrections were repeated twice to obtain the second approximation. Although an inspection of the data for the 2 houses shows that wind direction had some effect on the results, it was not possible to draw conclusions from the data and no corrections were made for wind direction. Unless otherwise noted, the data have been corrected by the foregoing procedure to separate the effects of wind velocity and temperature difference.

Results in I=B=R Research Home

The house air change rate is shown in Fig. 1 as a function of indoor-outdoor temperature difference corrected by 2 approximations for 0, 7.5 and 15 mph wind. The scattering of points is due partly to the wind data, which was taken from the University Weather Station and measured above the roof level where no trees or buildings obstructed it.

Wind velocity affected the infiltration as shown in Fig. 2. Infiltration rate increased with an increase in wind velocity. Wind direction may have an effect on infiltration provided there is unequal crackage on various sides of a building. In the Research Home it was not possible to correlate wind direction and infiltration. It can be seen from Figs. 1 and 2 that a change of 4 F in the temperature difference was equivalent to about a 1 mph change in wind velocity. Wind velocity had a special effect on the Research Home by increasing air flow up the chimney; this will be discussed later.

All points used in constructing the curves of Figs. 1 and 2 were obtained when the indoor temperature exceeded the outdoor temperature. Points with slashes represent a negative temperature difference and were not considered in drawing the curves. They indicate that the summer infiltration rate for a given temperature difference and wind velocity was lower than that for winter. This discrepancy can be explained by the effect of the chimney on increasing the house air change rate during the winter, as dis-

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**Formerly Research Assistant in Mechanical Engineering, University of Illinois, Associate Member of ASHAE.

†Research Professor of Mechanical Engineering, University of Illinois, Member of ASHAE.

[1] Exponent numerals refer to References.

For presentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 1957.

cussed later, and the additional shielding during the summer of leaves on the trees surrounding the Research Home.

When infiltration rate is estimated it is common practice to assume that no air passes through properly sealed wall construction. Infiltration rates for the Research Home, as calculated by the *crack* and *air change* methods. are shown in Figs. 1 and 2. The crack width for windows and doors was estimated from material in The Guide[2] 1956. The crack was assumed to be 0.04 in. for the weatherstripped windows and 0.09 in. for weatherstripped doors. For these calculations it was assumed that there was no air change between the house and attic and the house and basement. It is interesting to note that the infiltration rate estimated by the *crack* method and the *air change* method fall into good agreement with the test data. However, this is coincidental since the design value was based on wind velocity and did not consider temperature difference.

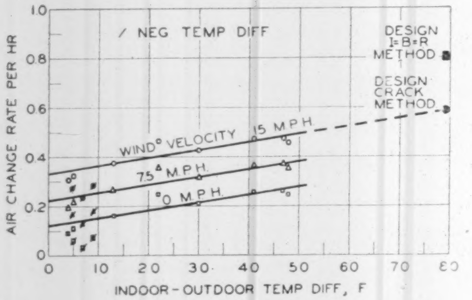

Fig. 1 *(left)* — Effect of temperature difference on first- and second-story air change rate in the I=B=R Research Home

When investigating infiltration rates it is helpful to consider the neutral zone or plane. The neutral zone is that elevation in a building where the pressure indoors is equal to that outdoors when the building is exposed only to an indoor-outdoor temperature difference. Air flows into the building below the neutral zone and out above it when the temperature indoors is greater than that outdoors. The flow pattern is reversed when the outdoor temperature exceeds the indoor temperature. In the Research Home the neutral zone was calculated to be 100 in. above the first-story floor level. To make this calculation is was assumed that there was no air change between the attic or basement and first and second stories, and that there was no air flow through the exposed walls. In order to determine the approximate location of the neutral zone, the measured indoor-outdoor pressure difference at several locations was plotted against elevation (Fig. 3). A negative pressure difference indicates that the indoor pressure was less than that outdoors. The letters beside each point indicate the exposure where the total pressure was measured. There may be a different neutral zone for each exposure when a wind is blowing, but Fig. 3 gives a mean neutral zone since the curve was drawn taking all points into consideration. A straight-line relation was assumed; however, this did not introduce a large error because the zero pressure difference usually occurred near the second-story pressure measuring level.

The indicated location of the neutral zone is shown in Fig. 4 as a function of the indoor-outdoor static pressure difference at the first-story floor level. The height of the neutral zone above the first-story floor increased with increased pressure difference, and the measured height of the neutral zone was always greater than that estimated from the crackage on the 2 floors. The difference in the estimated and measured neutral zone locations might be attributed to leakage through the second-story ceiling not considered in the calculation of the neutral zone location. However, if the ceiling did cause the difference, the neutral zone location should have occurred at some fixed point above the estimated location since the resistance to flow would be constant. Since the height of the neutral zone location varied during the tests another cause of the variation was suggested. The difference was attributed to the effect of the heating plant chimney.

In cold weather the chimney caused a partial vacuum in the basement which was replaced partly by air from the first story; this prevented some of the first-story infiltrating air from leaving the house through the second-story windows, giving an *effective* greater crack area in the second story than in the first story. The numbers by the points in Fig. 4 are the average indoor-outdoor temperature differences which give an indication of the heating plant operation. The chimney alone could cause a rise of the neutral zone above the second-story ceiling by creating a partial vacuum in the entire house.

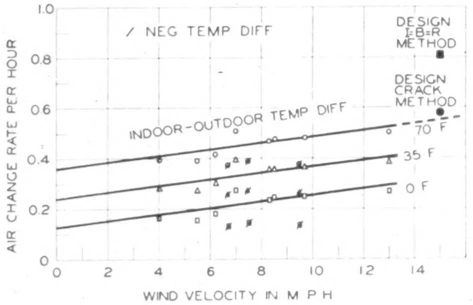

Fig. 2 *(right)* — Effect of wind velocity on first- and second-story air change rate in the I=B=R Research Home

Tests indicated air leakage from the house into the basement and into the attic. The slight attic leakage was probably around the fan-coil unit even though it was enclosed in a plastic seal. Smoke tests confirmed leakage of air through the kitchen door cracks into the basement.

Effects of indoor-outdoor temperature difference and wind velocity on indoor-outdoor static pressure difference at the first-story floor level during the heating season are shown in Figs. 5 and 6. The data have been corrected by the second approximation for 0, 35 and 70 F temperature differences and 0, 7.5 and 15 mph wind velocities. The curves show that a 1 deg F rise in temperature difference is equivalent to about a ¾ mph increase in wind velocity on the indoor-outdoor pressure difference. It is significant that temperature difference and wind velocity had similar effects on the pressure difference at the first-story floor level. That is, increases in temperature difference or wind velocity, caused a reduction in the indoor static pressure at the first-story floor level, making the indoor-outdoor pressure difference a larger negative amount. In buildings exposed to wind pressures, the infiltration through the windward side causes a pressure build-up inside the building which is a function of the wind velocity and the ratio of the crack areas on the windward and lee sides. Thus, it would be concluded that the wind had little direct effect on the pressures in the Research Home. However, the wind had an indirect effect on the pressures because of its effect on the air flow in the heating plant chimney. Further discussion of the chimney flow will follow later in this paper.

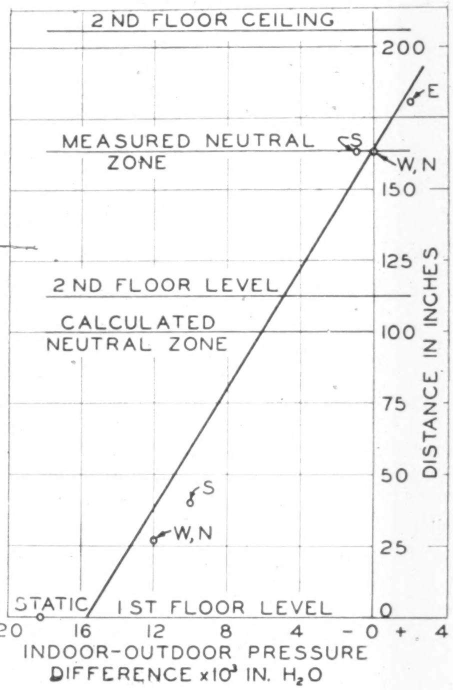

Fig. 3 (*left*) — Location of the neutral zone as determined by the indoor-outdoor pressure difference at various elevations in the I=B=R Research Home with south wind at 4 mph, February 10, 1956

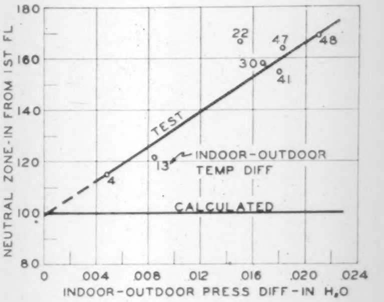

Fig. 4 — Effect of indoor-outdoor pressure difference (first floor level) on location of neutral zone in I=B=R Research Home

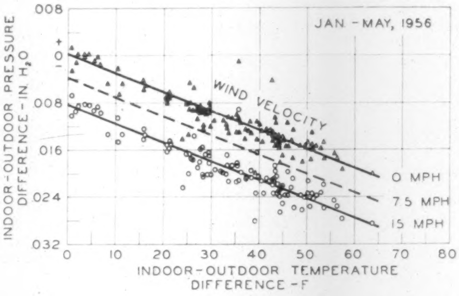

Fig. 5 (*left*) — Effect of temperature difference on indoor-outdoor pressure difference in the I=B=R Research Home

To determine the relationship between indoor-outdoor pressure difference and house air change rate, Fig. 7 was plotted using the static pressure difference at the first-story floor level. It can be seen that the house infiltration rate increased rapidly for a given change in indoor-outdoor pressure difference at the first-story floor level at a small pressure difference, but slowly for a larger pressure difference. The slope of the house air change—pressure difference curve would be different if the reference pressure difference were measured at another location. If the pressure difference had been measured nearer the neutral zone, but still beneath it, the slope of the curve would have been much greater. The limiting case would occur when the pressure difference was measured at the null point—the neutral zone. For this case, the vertical axis would represent the relationship of air change and pressure difference.

Journal Section

The effect of the heating plant chimney on the infiltration and pressure difference has been referred to frequently. Air and combustion gases leave the Research Home through the chimney at the rate of about 11,400 cu ft per hr[3] (0.8 air changes for the house including the basement) with an indoor-outdoor temperature difference of 35 F. The rate varied slightly depending upon temperature difference. It was estimated that the crackage of windows and doors in the basement and a separate flue for a gas water heater could supply about 90 to 95 percent of the air removed by the heating plant chimney. By comparing the winter and summer points on Figs. 1 and 2 it appeared that the combined effect of the chimney and bare trees increased the total infiltration by about 0.1 air changes during the winter as compared to summer conditions.

Effects of the chimney on the indoor-outdoor pressure difference at the first-story floor level are further shown by Figs. 5 and 6. It can be seen from Fig. 5 that with an increase in wind velocity there was an increase in indoor-outdoor pressure difference. This was the result of wind causing an additional air flow up the chimney, thus creating a greater suction in the basement which had a like, but lesser, effect on the first and second stories. The increase in air flow up the chimney caused by wind, in excess of that caused by temperature difference, ranged from 0 to 4000 cu ft per hr for an 8 mph wind, and from 3000 to 5000 cu ft per hr for a 15 mph wind. Thus, for a 15 mph wind the total flow in the chimney ranged from 14,000 to 16,000 cu ft per hr.

It may, therefore, be concluded that infiltration rates determined for the Research Home were slightly high due to leakage into the attic and basement, predominantly the basement. This explains the rise of the neutral zone with an increase in indoor-outdoor pressure difference, Fig. 4. The Research Home infiltration rate changed about 0.013 air changes per hr for each 4 deg increase in indoor-outdoor temperature difference or 1 mph increase in wind velocity.

Warm Air Heating Research Residence No. 2

Effect of indoor-outdoor temperature difference on infiltration rate is shown in Fig. 8. The original data have been corrected by the same method just described for wind velocities of 0, 7.5 and 15 mph. The data from days on which the temperature indoors was less than that outdoors have been distinguished by a slash. For each 1 F change in indoor-outdoor temperature difference the infiltration rate increased approximately 0.0066 air changes or 53 cu ft per hr. The summer infiltration rates (indicated with a slash) were of the same order of magnitude as the winter rates for the same absolute value of indoor-outdoor temperature difference.

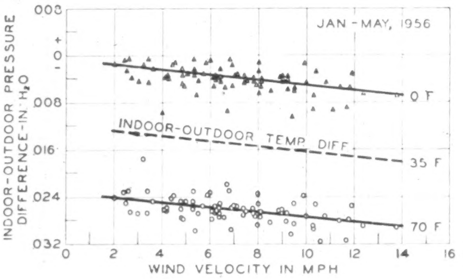

Fig. 6 (right) — Effect of wind velocity on indoor-outdoor pressure difference in the I=B=R Research Home

The effect of wind velocity on the infiltration rate is shown in Fig. 9 where the number of air changes is plotted as a function of wind velocity with the data corrected as before for temperature differences of 70, 35 and 0 deg. The cup-type anemometer used to obtain wind velocity during these studies was located about 23 ft above the ground level atop the weather station 40 ft north of the Residence. The recorded wind velocity may, therefore, be greater than the velocity at the level of the windows. The wind velocity at window level would be less than that measured at the anemometer and a correction for the difference would cause an increase in the slope of the air change curves. For each 1 mph increase in wind velocity the infiltration rate increased about 0.012 air changes or 97 cu ft per hr.

Part of the scatter of the points in Fig. 9 may be attributed to the effect of wind direction. Since the major part of the crack area was in the south and north walls, the highest air change rates would be anticipated when the wind was blowing from either of these directions. It was, however, impossible to draw any conclusions regarding the effect of wind direction.

The infiltration rate of the first story was estimated by the *crack* method and by the *air change* method using data given in THE GUIDE[2] 1956. In the *crack* method estimate, infiltration was assumed to occur in each room of the Residence without regard to wind direction. The length of crack used for computing the infiltration rate in each room was taken as the maximum crackage on one exposure. The total equivalent crack length used was 251 ft, or approximately 80 percent of the total equivalent crackage of the first story. The infiltration through the walls was assumed negligible. The estimated infiltration rates for design conditions during heating and cooling have been plotted on Figs. 8 and 9. Design heating and cooling air change rates, which were estimated by the *crack* method and based on wind velocities of 15 and 10 mph, respectively, were 0.75 and 0.40 air changes. The design heating air change rate estimated by the air change method was 0.69 air changes. The maximum winter air change rate of 0.8, which was observed on a day when the outdoor temperature was about 0 F and the wind velocity 7 mph, was approximately 7 percent greater than that estimated by the *crack* method and 16 percent greater than that estimated by the *air change* method. The maximum measured summer air change rate of 0.36, which was observed on a day when the outdoor temperature was 95 F and the wind velocity 8 mph, was 10 percent less than the design rate. Hence, within the limits of the assumptions made in the estimate, the agreement between the design air change and that measured when design conditions were approached can be considered good. It should be noted, however, that the good agreement was obtained by over-estimating the infiltration due to wind forces and by neglecting the infiltration due to temperature difference forces. Whether similar agreement would be obtained in situations where the wind forces are predominant is problematical.

The difference between indoor and outdoor static pressure at the first-story floor level was recorded during all infiltration tests. The outdoor pressure tap was 6 ft 2 in. above the peak of the roof, and assumed to be outside the pressure region caused by the flow of air around the house. The tubing connecting the tap to the draft gage was exposed to outdoor temperature to its point of entry at the first-story floor level. Hence, the recorded pressure differentials were equivalent to the static pressure difference at the floor level. The average pressure differentials observed during each test are plotted as a function of wind velocity in Fig. 10. Since the data showed a considerable deviation from a straight-line relationship, no attempt was made to make corrections to specific conditions of wind and temperature difference. However, the available data fell on curves of temperature difference ranging from 8 to 20 F in one case and 10 to 55 F in the other. The pressure build-up anticipated in structures exposed to wind forces occurred in Residence No. 2. Since the wind and temperature difference forces were acting simultaneously, one causing negative pressure differentials and the other causing positive pressure differentials, the resultant pressure difference was positive only when the effect of wind became dominant. As the temperature difference increased, the wind velocity required to cause positive pressure differentials at floor level also increased.

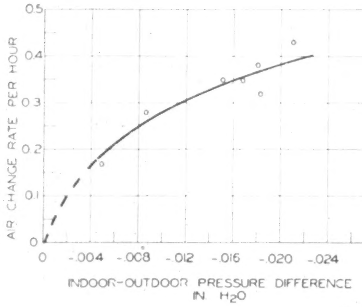

Fig. 7 (left) — Effect of indoor-outdoor pressure difference on first and second story air change rate in the I=B=R Research Home

Results of a previous[4] investigation showed that wind direction had an appreciable effect on the pressure differentials at floor level because of different crackages in the exposures of the house. In earlier studies, the effects of temperature difference were not considered, but the trends established for each exposure were similar to those of Fig. 10. With the wind blowing from some directions, namely the east, the pressure differences were always negative during the winter because of the small amount of crackage in the east exposure.

As mentioned previously, the choice of the location of the reference pressure influences the slope of the curves of house air change as a function of pressure difference. When both wind and temperature difference forces influence the reference pressure, as was the case in Research Residence No. 2, a family of curves would be required to show the relationship of total infiltration and pressure difference at the floor level. At zero pressure difference, the slopes of the curves would change from negative to positive when moving in a positive direction along the pressure difference axis. Since the data were limited, it was impossible to determine the relationship of infiltration and static pressure difference at the first-story floor level. Using the crack data for the first story and basement, calculation shows that the neutral zone is located approximately 30 in. above the first-story floor. For this estimation it was assumed that no air was passing through the walls or the first-story ceiling, that the resistance to air flow from the basement to the first story was negligible and that no air was leaving through the chimney.

With the crack areas around doors and windows known and the neutral zone located, it was possible to compute the relationship between indoor-outdoor temperature difference and wind velocity giving the same amount of infiltration in the first story. In this estimate it was assumed that infiltration due to wind forces would occur through one-fourth of the total crack of the first story and that due to temperature forces would occur through the total crack of the residence located below the estimated neutral zone. The flow through the cracks was assumed to vary with the square root of the pressure difference. This relationship is shown in Fig. 11 together with the actual relationship determined from the zero wind velocity and zero temperature difference curves of Figs. 8 and 9, respectively. Whereas the theoretical relationship indicates that the wind is the dominant effect, the results of the studies indicate clearly that the effect of temperature difference was more pronounced.

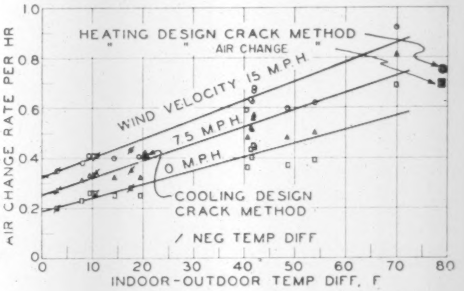

Fig. 8 (right) — Effect of temperature difference on first story air change rate in the Warm-Air Heating Research Residence No. 2

This difference can be explained if it is assumed that the flow resistance of the first-story ceiling is comparatively low. A low resistance in the ceiling would raise the neutral zone, and thus increase the amount of infiltration caused by temperature difference. It would, however, have very little influence when the wind is the only active force. It should be noted that the ceiling of Research Residence No. 2 is constructed of pressed cement-asbestos boards with taped joints. Even though no cracks were apparent, it was not possible to inspect the tightness of all joints. Recorded wind velocity and indoor-outdoor pressure difference data show that with zero wind there was as much suction at the floor level of the first story as theoretical calculations show when the neutral zone is assumed to be just at the ceiling level.

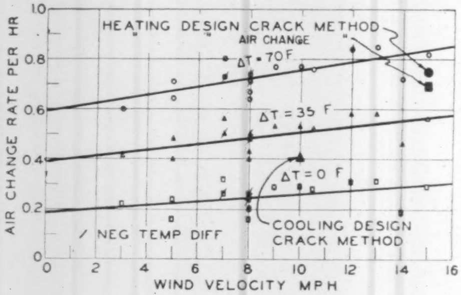

Fig. 9 *(left)* — Effect of wind velocity on first story air change rate in Warm-Air Heating Research Residence No. 2

Further explanation of the difference is found in the effect of the flow of gases in the chimneys. A considerable amount of air was leaving the basement through the chimneys during winter, both combustion air for the furnace and the water heater and air entering the smoke pipes through the draft diverters. The volume varied somewhat with outdoor temperature, but was an average of 4500 cu ft per hr, or approximately half an air change for the basement. Since this air was taken directly from the basement, it would seem reasonable that it would be replaced with outdoor air leaking in around the basement windows and air leaking down from the first story. Smoke tests showed, however, that during the heating season, air was always streaming from the basement into the first-story rooms. The magnitude of this air flow could not be determined.

As the amount of air leaving through the chimney increases, the suction in the basement increases, causing a decrease in the amount of basement air entering the first story. Consequently, the chimney causes the neutral zone to shift upward in the same manner as a low flow resistance in the first-story ceiling. It is likely that both factors contributed to the difference of the theoretical and actual relationships between wind velocity and temperature difference. The extent to which each factor affected the difference could not be ascertained from available data.

Although no helium was released into the basement during the studies, within a short period of time there was a considerable amount of helium in the basement air. During the winter studies, the basement helium concentration was attributed solely to leaks in the ductwork and furnace casing since, as was mentioned before, smoke tests showed that air was always streaming from the basement to the first story. During the summer studies, a portion of the helium in the basement air could be attributed to leaks in the ductwork; however, since the concentration of helium increased to a much higher level than had been noticed during the winter studies another source of helium was suggested. Since the theoretical location of the neutral zone was estimated 30 in. above the first-story floor, it was assumed that the air would flow from the first story to the basement. Smoke tests confirmed this assumption. This mixing of basement air and first-story air by leakage from the air distribution system and by gravitational effects had some influence upon the rate of decay of helium concentration in the first-story rooms. Consequently, there may be minor errors in the air change rates calculated from the observations.

Comparison of Results for the Two Residences

When comparing the results from the 2 houses it should be noted that the houses are similar in size and have almost equal crackages. The volumes of the 2 houses, excluding the basements, differ by only 1309 cu ft, the Research Home having the greater volume. The distribution of the cracks on the 4 exposures is almost the same in the 2 houses.

Although the houses are similar, their infiltration rates differ considerably, especially at high wind velocities and high temperature differences. With a 15 mph wind and a 70 F temperature difference, the infiltration rate of Research Residence No. 2 is about 50 percent higher that that for the Research Home. This difference can be explained by considering several factors. The Research Home is well protected from wind; this decreases the wind effects on infiltration. Wall and ceiling construction of the Research Home (plaster) is tighter than that of Residence No. 2 (plywood and pressed cement-asbestos board panels fastened with screws); this decreases the effects of both wind and temperature difference.

The tight contruction of the Research Home and the protection from wind is partially offset by the stack effect of the house. Since the Research Home is 2 stories high and Residence No. 2 is one story, there is a greater potential for air flow into and out of the Research Home than in Residence No. 2.

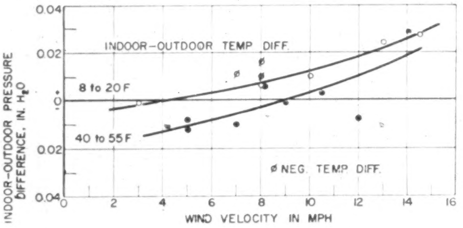

Fig. 10 *(right)* — Effect of wind velocity on indoor-outdoor pressure difference in Warm-Air Heating Research Residence No. 2

Difference in exposure to wind was shown by the measured indoor-outdoor pressure difference for the 2 houses. In the Research Home the wind increased the vacuum at the first-story floor level through its effect on the chimney draft. In Research Residence No. 2 a pressure build-up occurred at floor level when the effect of wind was greater than that of temperature difference. The effect observed in Residence No. 2 would be anticipated for a structure exposed to wind forces.

The heating plant chimney had a much greater effect on the infiltration in the I=B=R Research Home. The flow of gases in the chimney was on the average equal to 0.8 to 1.0 air changes for the entire house including the basement. Most of the air flow in the chimney infiltrated through cracks around the basement windows and the vent on a gas-fired hot water heater. However, the chimney caused the pressure difference at the first-story floor level to be greater than predicted through its effect on the location of the neutral zone. In Residence No. 2 the flow of chimney gases was equivalent to 0.27 air changes for the first story and basement, and the chimney apparently had a small effect on the infiltration. The influence of the chimney caused air to stream from the first story to the basement in the Research Home, but in Residence No. 2 the effect of the chimney was so small that the natural flow from the basement to the first floor was not interrupted.

As was mentioned previously, the validity of the tracer gas technique for measuring infiltration was questionable because of the extremely high diffusion rate of helium. It is conceivable that helium diffuses through the walls, ceilings and floors, thus indicating a higher than actual infiltration rate. The bottom curves of Figs. 1, 2, 8 and 9 suggest this fact since the curves do not pass through the origin, but intersect the air change axis, and indicate infiltration when there is no driving force (zero wind velocity and zero temperature difference). Furthermore, at zero wind velocity and zero temperature difference, the air change rate for the Research Home is about 0.12 and that for Residence No. 2 is about 0.19; this denotes that there would be more diffusion through the walls of Residence No. 2 than through the walls of the Research Home. It is apparent that helium would diffuse more readily through the walls of Residence No. 2 than through the walls of the Research Home if it is assumed that the wall construction resistance to water vapor diffusion is an index of its resistance to helium diffusion.

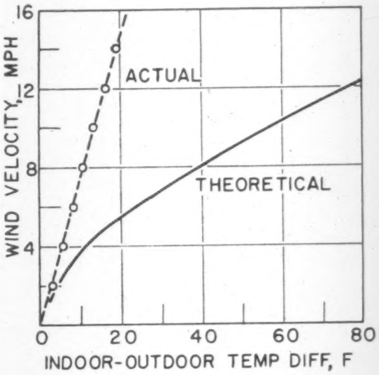

Fig. 11 — Theoretical and actual relation between indoor-outdoor temperature difference and wind velocity giving the same infiltration rate

Conclusions

1. Good agreement between measured and calculated air change rates was obtained. The good agreement was a result of over-estimating the effect of wind forces and neglecting the effect of temperature difference forces. In the *crack* method the maximum infiltration in each room is used to obtain the total infiltration for a structure. Since the wind can act on only one or two exposures, the design precedure leads to an over-estimate of the total infiltration caused by wind. If the 2 houses studied had been located in other climates, the agreement between measured and calculated infiltration rates would not have been as good because the temperature difference was an important factor in both houses.

2. The Research Home, which is located on a typical city site surrounded by large trees and houses, has a considerably smaller infiltration rate at a given wind velocity measured above tree top level than that of Research Residence No. 2, which is located on a relatively open site, free of trees, and typical of new housing developments.

3. The flow of flue gases in the chimneys of the 2 houses during the winter had an appreciable effect on their infiltration rates. The effect was more pronounced in the Research Home, which is a 2-story structure.

4. Loss of helium by diffusion through walls and ceiling may have caused the *apparent* air change rates to be greater than the actual rates.

Acknowledgments

Acknowledgment is made to the *Institute of Boiler and Radiator Manufacturers* and to the *National Warm Air Heating and Air Conditioning Association* for permitting their respective research staffs to participate in these studies and for allowing the studies to be conducted in their experimental houses.

The authors wish to thank H. Hagan, formerly visiting scholar from Norway, and C. F. Chen, formerly research assistant in Mechanical Engineering, for the collection and analysis of much of the data obtained in Warm-Air Heating Research Residence No. 2. The authors also wish to thank F. J. Poskocil, student assistant, for the collection of much of the data obtained in the I=B=R Research Home and for preparing many of the drawings in this paper.

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Fundamentals of Control

By

V. Robert Baird

The author is Technical Services Engineer, The Powers Regulator Co., Skokie, Ill. The presentation was made at the Symposium on Air-Conditioning Instrumentation at the Semi-Annual Meeting of the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, Murray Bay, Que., Canada, June 24, 1957.

FOR A CONTROLLED process to be fully complete, there must be a closed loop. In the heating process shown in Fig. 1, the valve may be positioned to deliver sufficient hot water to meet the load requirements when the outside temperature is 35 F. But when the outside temperature drops to 10 F, the valve must be adjusted to a more open position to supply enough hot water to meet the increased load requirements. Without a means for adjusting the valve, the process is incomplete and represents an open loop system.

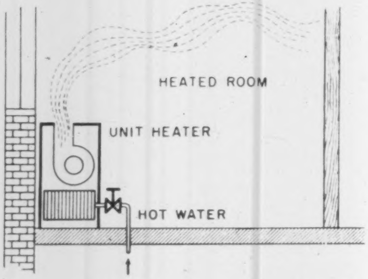

Fig. 1 — Diagram of simple heating process without means of adjusting valve — an open loop system

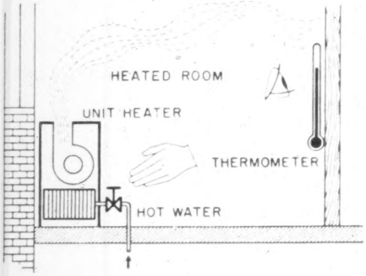

Fig. 2 — Diagram of manual operation of simple heating process — illustrates a simple closed loop system

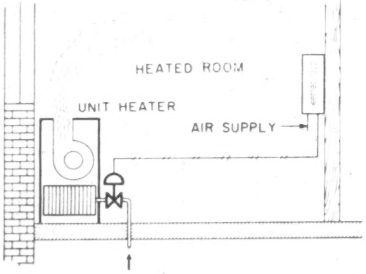

Fig. 3 — The human operator of Fig. 2 is replaced by means of automatic devices — the control process is now automatic

If a human operator is present to adjust the valve as in Fig. 2, the process represents a closed loop system. The eyes read the thermometer, send a signal to the brain which, in turn, sends a signal to the hands to make the adjustment. If the human operator is replaced by an automatic controlling means which is connected to the valve, the process becomes automatic. This is shown in Fig. 3. Here a thermal system, sensitive to temperature, causes the thermostat to pass a variable air pressure to the valve as a result of temperature change.

The component parts of a closed loop system are shown in Fig. 4.

SUMMARY—In the field of air conditioning, the increasing use of controls has produced need for a more concise understanding of fundamentals and terminology. This paper summarizes the characteristics of the more frequently used modes of control and defines the terminology involved.

With each part is shown the corresponding item from the room control problem with a human operator. The measuring means consists *of those elements which are involved in ascertaining and communicating to the controlling means the value of the controlled variable**.

This may be a pressure sensitive diaphragm, a float device, an electric thermocouple, or a thermal bulb. The controlling means consists *of those elements which are involved in producing a corrective action.* This may be an electric, pneumatic or hydraulic operator or human hands. The controlled device is *that portion of the controlling means which directly changes the value of the manipulated variable.* This may be a rheostat, valve or damper.

Process *comprises the collective functions performed in and by the equipment in which a variable is to be controlled.* This may be a temperature, liquid level, or pressure control system. Note that the controlling means compares the signal from the measuring means with the set point in giving a signal to the controlled device. Also, there are uncontrolled agents affecting the process, such as the heat from body loads and drafts.

Often one loop system forms part of another loop. In the room control process described, the actions of the human operator represent such an *inner* loop. The eyes were a measuring means, the brain a controlling means, and the hands the controlled device. Or, in the case of a cooking oven, the temperature control represents one loop. If, in addition, an insertion thermometer is used to measure degree of roasting, this control represents an *inner* loop which acts to turn off the oven at a prescribed temperature.

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*Extracted from Automatic Control Terminology, with the permission of the publisher, *The American Society of Mechanical Engineers*, 29 West 39th St., New York 18, N. Y.

A closed loop system is not always required. An electric toaster operated by a timer is not concerned with degree of toasting. In the control of temperature within a building, a master instrument sensing outside temperature is often used to set the temperature of the hot water system according to the outside temperature. The load of any particular room has no effect in this temperature setting and must be satisfied by a room loop system having a thermostat which controls a valve supplying heat to a coil.

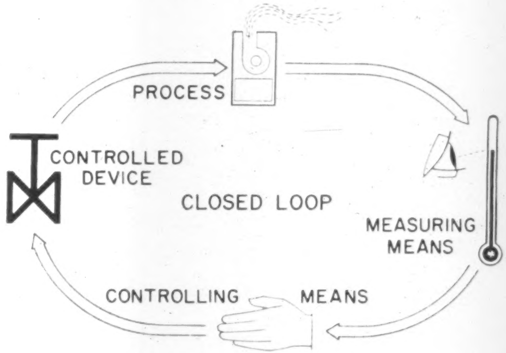


Fig. 4 — Components of a closed loop system

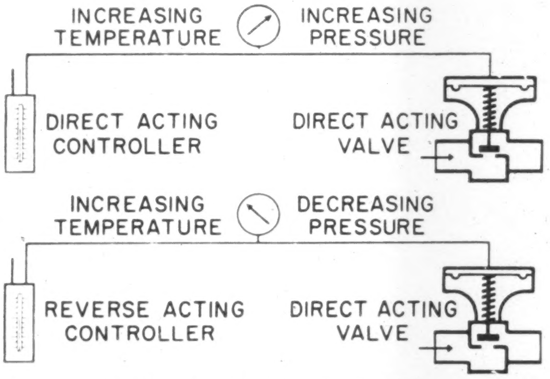


Fig. 5 — Diagram showing how direct acting and reverse acting pneumatic controllers operate

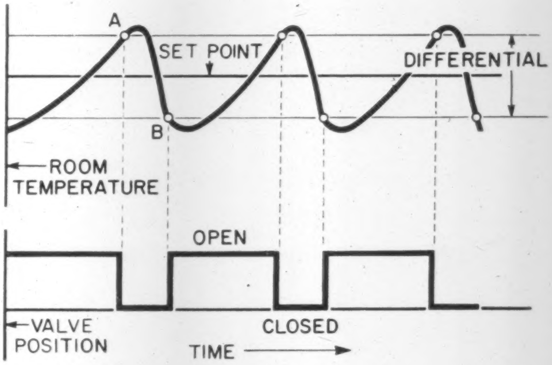


Fig. 6 — Pattern of how room temperatures may be expected to vary with two-position control

Types of Controller Action

The term *controller* refers to an instrument incorporating the measuring means and controlling means of the closed loop in one device. It receives the measurement signal of the controlled variable and puts out a signal to the controlled device in relation to the controlled variable.

Pneumatic controllers may be classed as either direct or reverse acting. Refer to Fig. 5.

A direct acting controller increases the control air pressure to the controlled device as the controlled variable increases.

A reverse acting controller decreases the control air pressure to the controlled device as the controlled variable increases.

Two-Position Control

In this form of control, there are only 2 positions for the controlled device: open or closed. Often this is referred to as *on-off* control. Because of the simplicity, this type of control is widely used in the control of household refrigerators and home heating systems. Often this control is used as a safety device in a system such as the high pressure cutout for a refrigeration compressor.

With two-position control, there is usually a differential setting. This is the difference between the cut-in and cut-out points. If the room previously described is operated by two-position control, the room temperature may vary as shown in Fig. 6. The set point, or desired value of controlled variable, is shown as a straight line. It is seen that the temperature oscillates about this value. When the temperature increases to A, the cut-out point, the valve is closed. When the temperature decreases to B, the cut-in point, the valve is opened. It is seen that when the valve is closed, the temperature continues increasing for a short time. Likewise, when the valve is opened, the temperature continues decreasing. This is because of the lags which are present in this and all control problems.

Lags

For any given situation, that lag which predominates may be of minimum concern in another system. Refer to Fig. 7. There may be a *capacity lag* in the unit heater due to the mass which must be heated for a rise in room temperature to occur. This is sometimes a favorable characteristic. Capacity absorbs and dampens the effects from large changes in valve position. As another example, the walls of a building offer capacity lag to the transfer of heat from the sun to the rooms within. This may be advantageous because the maximum room temperature will not occur until the occupants have left. The room air may possess a *transportation lag* because of the cooling which occurs from contacting room surfaces before reaching the thermostat. Transportation lag is a disadvantage because of the time which elapses before the thermostat senses the corrected air temperature. There may also be a *dead time* in the room control if the thermostat is located in a very remote location. There will be a time delay for the warmer or cooler air to reach the room thermostat, during which the thermostat will make no corrective action. Increasing the air velocity will reduce this dead time. Dead time is undesirable because of the time delay before the measuring means is aware of a change in the controlled variable.

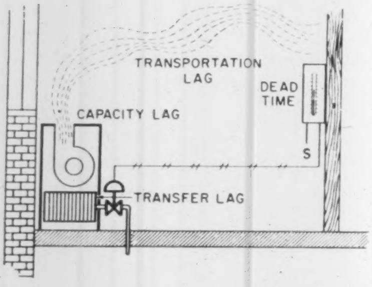


Fig. 7 — Diagram of where various types of lag occur

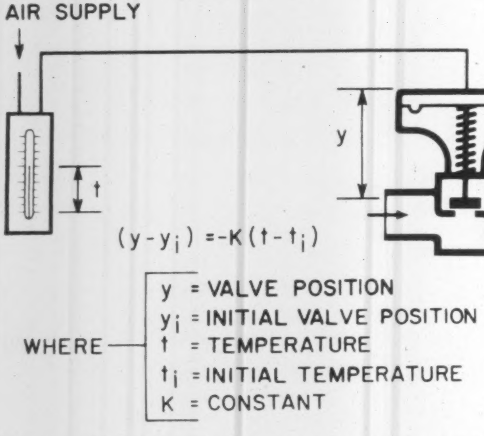


Fig. 8 — Proportional control and its mathematical representation

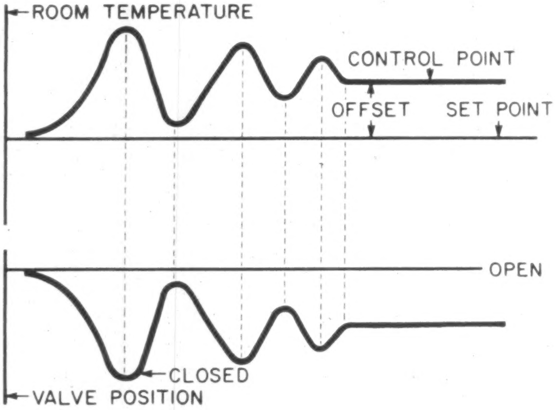


Fig. 9 — Pattern of how room temperature may be expected to vary with proportional control

In addition to the lags occurring in the process, there are lags within the control system. The thermostat will have a delay in measuring a changed temperature because of the mass of its sensing element, however small. Often this is desirable because a corrective action is not initiated for drafts and temperature variations of short duration which would otherwise cause continuous movement of the controlled device and excessive wear. Also, the controlled device will not move immediately because of friction which may be present.

Proportional Control

Because of the oscillation obtained with two-position control, its is apparent that a different control will be required for those processes which require the controlled variable to be held more constant. Such a form of control is known as proportional and often termed throttling, gradual or modulating. The term proportional will be used hereafter. The controller is designed to furnish an output in proportion to the input. Proportional control is defined *that in which there is a continuous linear relation between value of controlled variable and position of the controlled device.*

This control may be expressed mathematically. Refer to Fig. 8. A pneumatic thermostat controls the valve supplying heat to the room. Energy is supplied to the thermostat in the form of compressed air. Both the thermostat and valve are direct acting so that with an increase in temperature, the thermostat will pass a proportional increase in air to throttle the valve to a more closed position. Hence:

$$(y - y_i) = -K\ (t - t_i)$$

where

y = valve position.
y_i = initial valve position.
t = temperature.
t_i = initial temperature.
K = constant.

The valve must be set initially so that a given position will maintain a given temperature.

If the temperature in the room previously described is recorded while a heat load is introduced, a curve might be obtained as in Fig. 9. As the room temperature rises, the valve is moved to a more closed position. This will produce a decrease in room temperature. But this decrease results in moving the valve to a more opened position. The valve position and room temperature continue cycling until an equilibrium temperature is reached. This will be the new control point which is defined *the value of the controlled variable at which the instrument is controlling.* This control point will deviate from the original set point by an amount known as the *offset.* This is defined as *the difference between the set point and the actual control point at* *stable conditions*, and is also known as drift or deviation. A characteristic of proportional control is that there will always be an offset or droop after a change in load. The controlled variable will not return to the set point until the load returns to the initial value for which the set point was established.

That offset is an inherent characteristic of proportional control is more apparent when it is realized that for a new valve position a temperature change must occur. To maintain this position, the temperature must remain at the changed value. This produces the offset.

Many commercial controllers are provided with an adjustable *proportional band* or *throttling range*. Throttling range is *defined* as the amount of change in the controlled variable required *to move the controlled device through its complete stroke, from one extreme to the other*. If the valve varies the room temperature 100 deg in traveling ¾ in. (all other conditions constant) the throttling range is ¾ in. per 100 deg.

Usually throttling range is expressed as a percent of controller scale range. If a controller has a scale of 100 deg and 15 psi is required for full valve travel, the throttling range is 100 percent if the controller passes 15 psi as the temperature varies from 0 to 100 F. If the controller passes 15 psi as the temperature varies 50 deg, it has a throttling range of 50 percent. A temperature change of 50 percent of its scale produces a complete stroke of the valve.

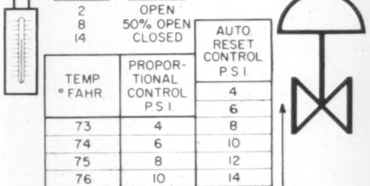


Fig. 12 — Action of a controller with automatic reset

Throttling range, when expressed in percent, may be shown as in Fig. 10. For 100 percent throttling, the line is at 45 deg. As the controlled variable changes through its entire range, the controlled device moves through its entire range. For the valve, this would be its entire travel. A throttling range of 10 percent is a line at nearly 85 deg with respect to horizontal axis because the controlled device will travel through its entire range with a small variation in controlled variable. A throttling range of 0 percent represents *on-off* control or two-position control.

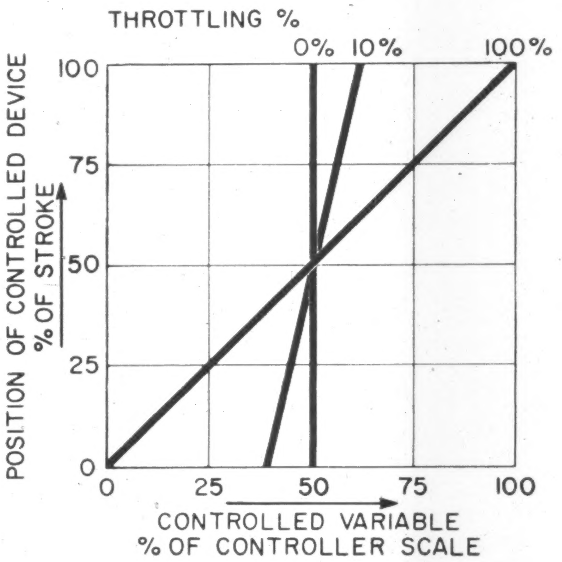
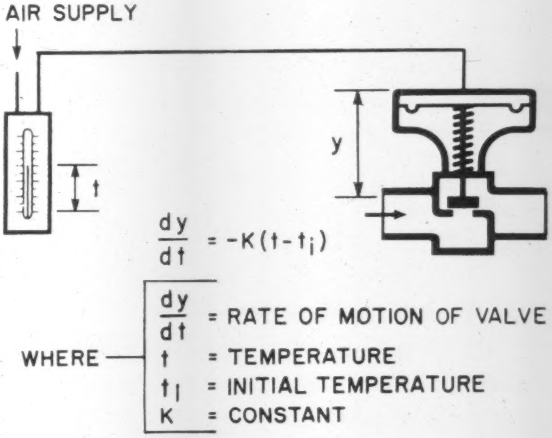


Fig. 10 — Throttling range expressed in percent plotted against position of controlled device



$$\frac{dy}{dt} = -K(t - t_i)$$

$\frac{dy}{dt}$ = RATE OF MOTION OF VALVE
t = TEMPERATURE
t_i = INITIAL TEMPERATURE
K = CONSTANT

Fig. 11 — Proportional speed floating control and its mathematical representation

Proportional Speed Floating Control

Because offset could be objectionable when precision control is necessary the control manufacturers have designed instruments to eliminate it. Such a controller incorporates a combination of proportional speed plus floating action. The proportional control offers a stabilizing effect, and the floating action, an output correction. Such a controller is known as having *automatic reset* or *integral control*.

This type of control is defined: *that in which the controlled device is moved at a speed proportional to the controlled variable deviation*. Referring to the valve in Fig. 11, this may be expressed mathematically:

$$dy/dt = -K\ (t - t_i)$$

where

dy/dt = rate of motion of valve.

t = temperature.
t_i = initial temperature.
K = constant.

The action accomplished by a controller with automatic reset is shown in Fig. 12. The thermostat and valve are direct acting. The valve throttles from fully opened to fully closed as the controlling pressure on its top varies from 2 to 14 psi. If the thermostat is a proportional control instrument, it will pass an air pressure in accordance with temperatures shown. But if it is replaced by a controller provided with automatic reset, the controller might pass pressures as shown in the right column, or other pressures depending upon the load variation. The right column may be visualized as a sliding scale of pressures which is lined up with the temperature scale. Therefore, if 8 psi is required to maintain 75 F in the room initially and an increased load is then introduced, the controller will adjust itself to pass 12 psi or some other pressure. This will then return the temperature to the set point and eliminate offset.

Rate Control

One form of control remains to be discussed—this is rate control. With rate control, the action of the controlled device is with respect to the rate of change of the controlled variable. Rate control is defined *that in which there is a continuous linear relation between rate of change of controlled variable and position of the controlled device.* This may be expressed mathematically as shown in Fig. 13.

$$(y - y_i) = -K\ (d\ temp/dt)$$

where

y = valve position.
y_i = initial valve position.
$d\ temp/dt$ = rate of temperature change.
K = constant.

This control cannot be used alone since it does not recognize the steady-state condition. It is used in combination with proportional control and is often known as derivative control. The action obtained is similar to that which would be obtained if a person were to rapidly close a steam valve when he saw the temperature rising in a plating tank. Once steady-state conditions are obtained in the controlled variable, regardless of magnitude, the controlled device returns to its original setting.

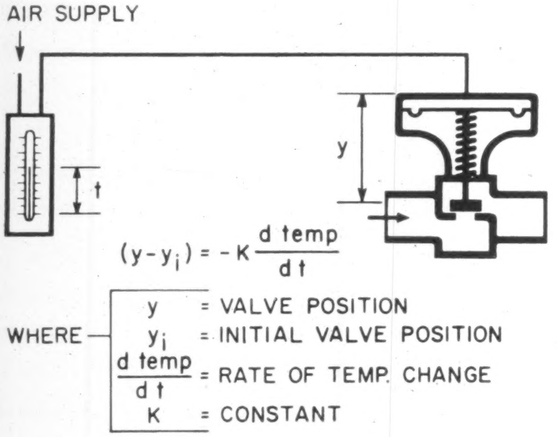

AIR SUPPLY
y
t
$(y-y_i) = -K\frac{d\ temp}{d\ t}$
WHERE
y = VALVE POSITION
y_i = INITIAL VALVE POSITION
$\frac{d\ temp}{d\ t}$ = RATE OF TEMP. CHANGE
K = CONSTANT

Fig. 13 — Rate control and its mathematical representation

Summary

While time has not permitted a more complete discussion, the author hopes this paper will promote a better understanding of the modes of control and terminology associated with air conditioning. The following items might be summarized:

1. A closed loop is necessary for complete control of a process although there are situations where incomplete control is desired. An open loop is then required.
2. Two-position or *on-off* control may be used where the magnitude and frequency of oscillation of the controlled variable are not of serious concern.
3. There are lags in any control system, some of which may be desirable.
4. Proportional control provides the gradual action usually required but causes an offset in the controlled variable when the load changes.
5. Many controllers have an adjustable throttling range.
6. Automatic reset control eliminates *offset* with a change in load.

Acknowledgment

The author wishes to thank C. A. Gustafson and R. A. Hegberg of The Powers Regulator Co. for their suggestions and assistance in preparation of the paper.

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HEATING VENTILATING AIR CONDITIONING GUIDE (published by the AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS, New York, copyright 1956).

Principles of Industrial Process Control, by D. P. Eckman (John Wiley & Sons, Inc., New York, 1952).

Proposed Standard for Comfort Air Conditioning

This Proposed Standard has been prepared as a replacement for the Code of Minimum Requirements for Comfort Air Conditioning (1938). The purpose of this Standard is to state desirable air conditions for comfort for sedentary people normally clothed.

The committee which prepared the Standard was composed of members representing a number of organizations as follows:

Walter L. Fleisher, Chairman; ASHAE: O. W. Armspach, A. C. Buensod, C. C. Cheyney; ASME: Carl F. Kayan; ARI: J. A. Gilbreath, R. A. Gonzalez, G. S. Jones; ASRE: F. H. Faust, C. F. Holske, S. P. Soling; U. S. Public Health Service: W. Clark Cooper, M.D.; Medical Profession: W. J. McConnell, M.D.; Members at Large: M. K. Fahnestock, P. J. Marschall, G. E. May, A. B. Newton.

The ASHAE Standards Committee invites comments and criticisms of this proposed Standard for a period of 60 days after which a final draft will be prepared for adoption by the ASHAE and other organizations represented. Comments should be sent to ASHAE Standards Committee, 62 Worth St., New York 13, N. Y.

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- 5.1 Temperature variation
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Appendix — Reference codes and data

Section 1. Purpose and Scope

1.1 **The purpose** is to state desirable air conditions for comfort for sedentary people normally clothed.

1.2 **The method of calculating** design loads and the application of equipment to meet the requirements of such loads are not part of this standard.

Section 2. Definition

2.1 **Comfort air conditioning** is the process of treating air so as to control simultaneously its temperature, humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space.

Section 3. Thermal Conditions for Comfort

3.1 Heating

3.1.1 **The dry-bulb temperature** at the 5-ft level should be within the range 73 to 77 F, and the relative humidity within the range 25 to 60 percent.

3.1.2 **Excessive radiant cooling effects** from surfaces which are considerably below the room air temperature should be compensated for by increasing surface temperatures, supplying radiant heating means, increasing the dry-bulb temperature, or a combination of these methods.

3.1.3 **The relative humidity** should be limited to values which will not cause undesirable condensation on windows and in the building structure. With a relative humidity below 25 percent, objectionable static electricity may develop.

3.1.4 **The temperature gradient** for a heating system in good residential and commercial construction should not be more than 1 F deg per ft within the levels occupied by people.

3.2 Cooling

3.2.1 **The dry-bulb temperature** at the 5-ft level should be within the range 73 to 77 F, and the relative humidity should not exceed 60 percent.

Section 4. Air Quality

4.1 **The outdoor air required,** where the only source of contamination is

Table 1 — Outdoor Air Required for Air-Conditioned Spaces

Application	Amount of Smoking	Outdoor Air: Cfm per Person — Recommended	Outdoor Air: Cfm per Person — Minimum[a]	Outdoor Air: Cfm per Sq Ft of Floor — Minimum[a]
Apartment	Some	20	15	0.33
Banking Space	Occasional	10	7.5	—
Barber Shops	Considerable	15	10	—
Beauty Parlors	Occasional	10	7.5	—
Cocktail Bars	Heavy	30	25	—
Stores	None	7.5	5	0.05
Drug Stores	Considerable	10	7.5	—
Factories	None	10	7.5	0.10
Funeral Parlors	None	10	7.5	—
Hospitals — Private Rooms	None	30	25	0.33
Hospitals — Wards	None	20	15	—
Hotel Rooms	Heavy	30	25	0.33
Meeting Rooms	Very Heavy	50	30	1.25
Offices — Private	None	25	15	0.25
Offices — General	Some	15	10	—
Restaurants	Considerable	15	12	—
Cafeterias	Considerable	12	10	—
Theaters	None	7.5	5	—

[a] When minimum is used, take the larger value from the two minimum columns.

the human occupant, is dependent upon a number of factors such as dietary and hygienic habits of the occupants, amount of smoking, air space allowed per person, and the odor-absorbing capacity of the air conditioning process. The quantity of such outdoor air for the most common applications should be as given in Table 1.

4.2 Contaminant removal

4.2.1 Where contamination of air may occur **due to hazardous** gases such as carbon monoxide, produced by heating, cooking and industrial processes, these contaminants should be eliminated at the source by local exhaust ventilation.

4.2.2 Where contamination of air may occur **due to non-hazardous** matter, including volatile vapors and gases, these contaminants should be eliminated at the source by local exhaust ventilation or by chemical treatment.

4.2.3 Contaminants which should be removed by accredited methods are dusts, fumes, smokes, mists, fogs, vapors, deleterious gases, airborne allergens, and harmful bacteria or other micro-organisms.

Section 5. Air Distribution

5.1 The quantity and temperature of the treated air and the method of introducing it to the conditioned space should be designed to limit the variation in dry-bulb temperature to 3 F deg at the 5-ft level throughout that portion of a single room which is normally occupied by people.

5.2 Air motion exceeding 40 fpm should be avoided in the zone between the floor and 5-ft level.

APPENDIX A
REFERENCE CODES AND DATA

The following codes may be of interest in the *application* of air-conditioning equipment in accordance with the Standards for Comfort presented herein:

Application Standards

a. Application Engineering Standard for Air Conditioning, Standard No. 530 *(Air-Conditioning and Refrigeration Institute)*.

b. Engineering Standards Part IV, Comfort Air Conditioning *(Mechanical Contractors Association of America)*.

Safety Standards

a. ASA B9.1, Safety Code for Mechanical Refrigeration *(American Standards Association)*.

b. Standards for the Installation of Warm Air Heating, Air Conditioning and Ventilating Equipment,—Pamphlets Nos. 90A and 90B *(National Fire Protection Association)*.

c. Standards for Air-Conditioning, Commercial and Domestic Refrigeration Equipment, Subject 207-A *(Underwriters' Laboratories, Inc.)*.

Rating and Testing Standards

a. Standard Method of Rating and Testing Air Conditioners, *ASRE* Standard No. 16-53 *(American Society of Refrigerating Engineers)*.

b. Standard Methods of Rating and Testing Mechanical Condensing Units, *ASRE* Standard No. 14-41 *(American Society of Refrigerating Engineers)*.

c. ASA B60.1, American Standard Method of Rating and Testing Refrigerant Expansion Valves *(American Standards Association)*.

d. Standard Methods of Rating and Testing Evaporative Condensers, *ASRE* Standard No. 20 *(American Society of Refrigerating Engineers)*.

e. Standard Methods of Rating and Testing Water-Cooled Refrigerant Condensers, *ASRE* Standard No. 22 *(American Society of Refrigerating Engineers)*.

f. Standard Methods of Rating and Testing Water and Brine Coolers, *ASRE* Standard No. 24 *(American Society of Refrigerating Engineers)*.

Equipment Standards

Air-Conditioning and Refrigeration Institute.

Design Loads, Components and Methods of Calculating Loads

Latest edition of the HEATING VENTILATING AIR-CONDITIONING GUIDE (AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS).

ANNUAL REGIONAL MEETINGS HELD

During the spring each Chapters Regional Committee holds its annual meeting. Reported here are the meetings of the committee for Region 4 at Los Angeles and for Region 6 at Tulsa. Noted also are the Region 5 men who were elected to the Nominating Committee of the Society.

Region 4 at Los Angeles

The meeting of the Chapters Regional Committee for Region 4 was held in 2 sessions, 1 on the afternoon of May 6 and the other on the afternoon of May 7, at the Ambassador Hotel In Los Angeles, Calif.

W. O. Stewart
Region 4 Regional Director

Regional Director W. O. Stewart, Los Angeles, Calif., presided at the sessions at which the following delegates and alternates were present: J. B. Hoaglund, member, and E. P. Maxwell, alternate member, Arizona Chapter; J. E. Murray, member, and K. F. Baldwin, alternate member, Golden Gate Chapter; V. W. Thornburg, member, and M. J. Delavan, alternate member, Sacramento Chapter; H. F. Ulovec, member, and W. J. Biggar, alternate member, Southern California Chapter; W. B. Hayes, member, and W. R. Norte, alternate member, Oregon Chapter; E. W. Triol, member, and M. A. McKinstry, alternate member, Puget Sound Chapter; and J. A. Doyle, member, and Max Tonn, alternate member, Inland Empire Chapter. J. B. Hoaglund, Phoenix, Ariz., was elected as secretary of the committee.

With the Southern California Chapter as hosts, the chapter had also arranged an extensive program of events for the 2 days. The chapter meeting events, also held at the Ambassador Hotel, included 2 morning technical sessions, a Banquet on the evening of May 6 and a luncheon on the afternoon of May 7. Members and alternates of the Chapters Regional Committee attended many of the chapter meeting events. The combined meetings of the chapter and the Chapters Regional Committee drew a large attendance with a total of 338 members and guests officially registered.

The meetings of the Chapters Regional Committee attracted many visitors, and problems of chapter operations and suggestions for improvements were discussed during the sessions. Resolutions were passed by the delegates for submission to the Council, and prominent in the discussions was the subject of codes and standards.

At an executive session of the members of the Chapters Regional Committee, the group selected J. E. Murray, San Francisco, Calif., member; L. A. O'Meara, Sacramento, Calif., first alternate; and R. M. Stern, Seattle, Wash., as second alternate on the Nominating Committee.

Among those in attendance in addition to the members and alternates from the chapters were Pres. P. B. Gordon, New

York, N.Y., and 2nd Vice Pres. A. J. Hess, Los Angeles, Calif.

A popular event on the chapter meeting program was a reception given to President Gordon on Sunday evening, May 5th. President Gordon also spoke at the Banquet on Monday evening on the subject *Our Bottleneck—Technical Know-how.* 2nd Vice President Hess was the luncheon speaker at the noon luncheon on Tuesday, May 7, using as his subject *Plant Husbandry.*

At the luncheon on Monday, the large crowd present had the pleasure of listening to H. P. Hayes, Dean of Engineering at the California State Polytechnic College, San Luis Obispo, Calif. Dean Hayes took as his subject *Recruiting Personnel for Our Industry.*

P. B. Gordon
ASHAE President

At the Banquet on Monday evening, featured by the address of President Gordon, an event of interest was the presence at the head table of Life Member E. C. Evans, and another was the initiation of the practice of presenting placques to past presidents of the chapter, and also the introduction of the members and alternates of the Chapters Regional Committee.

During the first session, held on Monday morning, May 6, 3 papers were presented as follows: *Calculations Investigating the Application of Air Conditioning to a School,* by F. M. Neal and D. L. Williams; *Control of Air-borne Sound Transmission,* by J. B. C. Purcell; and *An Investigation of Filter Systems for Removing Irritants from Polluted Air,* by Neil Richardson.

The second technical session held on Tuesday morning took the form of a symposium on the subject *Air Conditioning of Existing Buildings,* and C. B. Gamble, consulting engineer, New Orleans, La., acted as moderator. C. Milton Wilson was assigned the topic *High Velocity Air Systems;* Albert Hanson had the topic *Individual Chilled Water Units;* Frank White had the topic *Individual Package Units;* M. J. Wilson was assigned *Weathermaster Systems,* and C. W. Pollock had the subject *Conventional Air-Duct System.*

The whole chapter project was under the direction of Chapter Pres. H. F. Ulovec, while the Committee on Arrangements consisted of R. C. Taylor, *General Chairman;* W. L. Holladay, *Program;* G. A. Bloch, *Arrangements;* C. T. Snider, *Banquet;* R. B. Wilkerson, *Attendance;* H. F. Haldeman, *Special Invitations;* J. L. Blake, *Special Events;* Mary C. Wong, *Ladies Events;* R. W. Thomas, *Finance;* and J. R. Hall, *Publicity.*

Region 5 Men on Nominating Committee

At the meeting of the Chapters Regional Committee for Region 5 in New Orleans on May 2, 1957, R. O. McGary, Charlotte, N. C., was elected a member of the Nominating Committee of the Society, while R. K. Rouse, Greenville, S. C., was elected first alternate member, and W. G. Robertson, Jr., Baltimore, Md., was elected second alternate member.

Region 6 at Tulsa

May 10 was the date of the meeting of the Chapters Regional Committee of Region 6; the place was the Alvin Plaza Hotel at Tulsa, Okla.

Regional Director D. M. Mills presided when the meeting was opened for its morning session, and J. D. Ryan, Tulsa, was elected as secretary of the committee.

A roll-call showed the following members and alternate members of the committee as being present: J. W. Thompson, member, and Allen Bullard, alternate member, Arkansas Chapter; J. S. Malahy, Jr., member, Shreveport Chapter; F. H. Bridgers, member, and J. K. James, alternate member, New Mexico Chapter; F. R. Denham, member, and W. R. Johnson, alternate member, Oklahoma Chapter; J. D. Ryan, member, and Clarence Dollmeyer, alternate member, Northeastern Oklahoma Chapter; G. H. Meffert, member, and O. H. Mehl, alternate member, North Texas Chapter; E. B. Appling, member, and W. A. Sharp, alternate member, South Texas Chapter; D. T. Kern, member, and O. A. Brynie, alternate member, Southwest Texas Chapter; B. C. Melanson, member, and T. F. Sartor, alternate member, West Texas Chapter; A. C. Lagow, member, and B. J. Barnhart, alternate member, Austin Chapter; J. O. LeBeau, Jr., member, and M. D. Goodwin, alternate member, El Paso Chapter; C. R. Gardner, member, and T. B. Romine, Jr., alternate member, Ft. Worth Chapter.

Both the morning and afternoon sessions were taken up with the discussion of topics on the agenda prepared for the meeting. An important item of business was the election of G. H. Meffert, Dallas, Tex., as member; of J. W. Thompson, Little Rock, Ark., as first alternate member; and of F. R. Denham, Oklahoma City, Okla., as second alternate member of the Society's Nominating Committee.

D. M. Mills
Region 6 Regional Director

At the luncheon meeting the members and alternates were entertained by a picture show put on by the Oklahoma Chapter, and showing architects, engineers and owners engaged in building construction work.

In the evening the Northeastern Oklahoma Chapter and the Oklahoma Chapter held their monthly meeting as a joint affair at the Alvin Plaza Hotel, with dinner, and featured by an address by Pres. P. B. Gordon on the subject *Our Bottleneck — Technical Know-how.*

ACTIVITIES OF SOCIETY CHAPTERS

Society Officers and Council members were honored guests at several recent chapter meetings. Technical and Non-technical programs were presented; Elections and Appointments announced; Student Activities varied. Personal recognition was paid to numerous members. Featured were a Puget Sound Old Timers meeting and a presentation to Carl H. Flink of New York Chapter.

Officer and Council Visits

Society Pres. P. B. Gordon, New York, N. Y., was the honored guest at an ATLANTA Chapter meeting. In his talk on *Our Bottleneck—Technical Know-how,* Mr. Gordon forcefully demonstrated how the unexpected growth of our industry in recent years had produced likewise unexpected possibilities in air conditioning, particularly in the residential and industrial fields. • • • Pres. S. R. Plamondon, MONTREAL Chapter, introduced J. H. Fox, member of Council and then regional director of Regional Area 7, at a meeting of the chapter. Mr. Fox expressed his pleasure at the healthy standing of this region and the progress being made. • • • An interesting talk on the Plant-growing laboratory at California Institute of Technology was given at a NEBRASKA Chapter meeting by A. J. Hess, 2nd vice president of the Society, Los Angeles. The members also heard John Everetts, Jr., member of Council and regional director, Regional Area 1, in a short talk on ASHAE research work, with stress on its importance to both members and industry. • • • NEW MEX-

ICO Chapter also was visited by 2nd Vice President Hess. As guest speaker, he selected the subject of *Trends in Air Conditioning and Refrigeration*, making interesting predictions on the future of the field. • • • Society President Gordon told the NEW YORK Chapter about the value of the regional meetings. He stated that they had proved to be helpful to both the chapters and the Society by providing a means for receiving suggestions from the Council as well as transmitting ideas from the membership to the Council. • • • The activities of the Society were discussed at an ONTARIO Chapter meeting by W. G. Hole, member of Council and the new regional director of Regional Area 7. He urged that all members participate in these activities as much as possible in order to get the maximum value from membership. • • • In an introductory talk to the members of the TOLEDO Chapter, P. J. Marschall, member of Council and regional director of Regional Area 2, spoke of the growth of the Society, its research program, the requirements for various member grades and the activities of the Membership Committee. The subject of Mr. Marschall's main talk was *Control of Industrial Environment.* • • • John Everetts, Jr., gave his informative talk on *Society Research* for the benefit of the members of the WESTERN NEW YORK Chapter.

J. H. Fox
Compliments Montreal Chapter

Technical Programs

An ARIZONA Chapter speaker, P. W. Wyckoff, chief engineer, Airtemp Division, Chrysler Corp., Dayton, Ohio, devoted himself to *Residential Application and Operating Costs of the Waterless Air Conditioner.* • • • BATON ROUGE Chapter has programmed a number of informative presentations at recent meetings. Frank Vaughn, Sporlan Valve Co., St. Louis, Mo., dealt with practical aspects of refrigeration systems. The *Proper Care of Cooling Towers and Evaporative Condensers* was treated by John Crane, chief engineer, Micromet Division, Calgon, Inc., Pittsburgh, Pa.; and J. P. Waldrop, sales engineer, B & W Metals Co., Houston, Tex., discussed the *Proper Venting of Gas-Fired Equipment.* Still another program was devoted to a demonstration. • • • Preliminary remarks by D. W. Thomson, president of the BRITISH COLUMBIA Chapter and consulting mechanical engineer, Vancouver, B.C., briefly described the system at the new British Columbia Electric Building, which the chapter members later visited. • • • The *Use of Atomic Energy in the Generation of Commercial Electric Power* was covered at a CONNECTICUT Chapter meeting by C. T. Hughes, vice president and consulting engineer, Connecticut Light & Power Co. Mr. Hughes spoke particularly of the Yankee reactor to be built at Rowe, Mass., to serve approximately one dozen New England electrical utilities. • • • On another occasion, the Connecticut Chapter members listened to a presentation on *High Temperature Hot Water Heating Systems* by J. H. Hanley, Bell & Gossett Co., Newington, Conn. He also treated expansion tank applications. • • • DELTA Chapter members heard an interesting talk on *Cooling Tower Preventive Maintenance* by John Crane, Calgon, Inc., Pittsburgh, Pa. • • • The *Ramblings of an Environmental Engineer* were described for the EL PASO Chapter members and their guests by Frank Merry, acting chief, environmental and general branch, Electro-Mechanical Laboratory, WSPG. • • • At a FORT WORTH Chapter meeting, W. L. Lipski, engineer, Air Balance Co., Dallas, Tex., queried *Is Air Balancing Necessary?* The methods, measurements and calculations by which proper systematic balance is obtained were explained in detail by Mr. Lipski. • • • Members and guests of the Fort Worth Chapter also heard D. D. Wile, vice president and chief engineer, Refrigeration Engineering, Inc., Los Angeles. Mr. Wile spoke on the problem which was besetting Fort Worth that evening—the proper design of air-conditioning systems for mild, humid weather. • • • Two speakers graced the rostrum at an ILLINOIS Chapter meeting. They were H. E. Ziel, mechanical engineer, Albert Kahn, Associates, Detroit, Mich., and W. G. Hazard, chief engineer of industrial ventilation, Owens-Illinois, Toledo, Ohio. Mr. Hazard opened the program, speaking on the importance of control of radiant heat in industrial work and on the use of proper ventilation. He advised that the effects of radiant heat are too infrequently taken into consideration in industrial plants and that a very considerable amount of heat is emitted by hot equipment. Mr. Hazard presented a demonstration on the effects of radiant heat on a model which was subjected to radiant rays and convected heat. In conjunction with his comments on industrial ventilation, he suggested that variable louvers be installed for makeup air so that the air current may be directed where described. Then the second speaker, Mr. Ziel, described various methods of introducing air for comfort conditions in industrial plants. He mentioned several possible ways to introduce air at an 8-ft. level, and concluded by showing slides depicting typical industrial installations. Comments from the floor attested to the excellent quality of the speeches. • • • J. R. Carroll, assistant professor of mechanical engineering, University of Illinois, Urbana, Ill., gave the INDIANA Chapter the benefit of his knowledge on high temperature hot water. • • • An IOWA Chapter member, H. E. Straub,

H. E. Straub
Featured Iowa Chapter Speaker

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Journal Section

research engineer, Titus Manufacturing Corp., Waterloo, Ia., was the featured speaker at a meeting of his chapter. Mr. Straub based his discussion of *Principles of Room Air Distribution* on 4 years of study and tests conducted at the University of Illinois in conjunction with *A.G.A.* With the help of slides, he showed the relationship between air velocity and room temperature variation in both the cooling and heating seasons. Mr. Straub also pointed out how the velocity of the primary air supply effects the induction of secondary room air and the area of the stagnant air layer. • • • KANSAS CITY Chapter programmed a presentation on *Characteristics of Forced Hot Water Heating* by Frank Gall, sales promotion manager, Bell & Gossett Co., Morton Grove, Ill. Mr. Gall conducted a stimulating discussion. • • • An informative talk by P. C. Sinnot, B. F. Sturtevant Co., division of Westinghouse Electric Corp., Galt, Ont., was delivered before a MANITOBA Chapter audience. Mr. Sinnot identified applications for electrostatic filters, compared various types of filters and apprised the members of new developments in the general filter field. • • • A positive trend, according to another Manitoba Chapter speaker, is toward essential planning for refrigeration and air-conditioning equipment in new office buildings, stores and public assemblies. The speaker, B. E. Judges, manager, refrigeration sales, Trane Company of Canada, Ltd., Toronto, Ont., depicted the history of refrigeration compressors and various refrigerants, outlining the revolutionary steps in design. • • • *Black Magic* was the title of a talk on activated charcoal scheduled for a MINNESOTA Chapter meeting. The interesting program was offered by H. L. Barnebey, vice president, Barnebey-Cheney Co., Columbus, Ohio. An extensive question and answer session followed. • • • The *Industrial Developments in the State of Mississippi* were covered in an address before the MISSISSIPPI Chapter by H. S. Thomas, Mississippi Power & Light Co., Jackson, Miss. The accompanying slide presentation completed the picture. • • • *Schoolhouse Controls* was the topic of another Mississippi Chapter presentation. This talk by F. M. Neal, sales engineer, Minneapolis-Honeywell Regulator Co., Los Angeles, Calif., provoked considerable discussion among those present. • • • In a speech on *Selection and Performance of Counterflow Cooling Towers* given at a NEW YORK Chapter meeting by John Engalitcheff, Jr., president, Baltimore Aircoil Co., Inc., Baltimore, Md., the speaker outlined the various factors that affect the performance of cooling towers, particularly the counterflow type. The development and use of a tower performance chart was explained with illustrative examples showing how changes in air wet-bulb temperatures and air volume would affect performance. Mr. Engalitcheff was given a rising vote of thanks following the presentation. • • • At a meeting of the NORTH TEXAS Chapter, D. D. Wile, Recold Corp., Los Angeles, Calif., spoke on the control of direct expansion air-conditioning systems, with emphasis on humidity control. • • • Previously, a North Texas Chapter audience heard B. W. Ellis, Buffalo Pump Division, Buffalo Forge Co., Dallas, Tex., in a most interesting talk on *Noise in Centrifugal Pumping Systems, and Mechanical Considerations of Centrifugal Pump Design as Affected by High Working Pressure.* • • • *Residential Application and Operating Costs of the Waterless Air Conditioner* were treated at a NORTHEASTERN OKLAHOMA Chapter meeting by W. J. Radle, performance analyst, Airtemp Division, Chrysler Corp., Dayton, Ohio. In his informative presentation, Mr. Radle discussed performance under varying conditions, annual operating costs, and arrangement of equipment. • • • NORTHERN ALBERTA Chapter members toured the new City Sewage Treatment Plant, Edmonton, Alta. Messrs. Bentley and Booth, of the City of Edmonton, described the construction and operation of the plant, and conducted the tour. • • • S. T. Bowen, sales engineer, The Cleveland Electric Illuminating Co., Cleveland, Ohio, spoke to the NORTHERN OHIO Chapter on operating costs of the heat pump. The speaker cited a number of examples. Following a question and answer period, the audience viewed a movie entitled *The Chemical Shore.* • • • Pres. H. R. Canoyer commented on the excellent turnout at another Northern Ohio Chapter meeting, held in early spring. Despite a cold snowy windswept night, 40 members came to hear Albert Milnes, vice president, Sarco Co., Inc., New York, N. Y., speak on *Steam Traps.* • • • J. W. McA. Kreuttner, vice president, Buensod-Stacey, Inc., New York, N. Y., was the speaker at a NORTHERN PIEDMONT Chapter meeting. Mr. Kreuttner defined a dual-duct system, and outlined its history and principle of operation. One of the most interesting points in this talk on dual-duct systems was a cost analysis for different arrangements. Mr. Kreuttner gave an expert presentation of his subject. • • • In some introductory words at an OREGON Chapter meeting, C. W. Nessell, industry consultant, Minneapolis-Honeywell Regulator Co., Mt. Prospect, Ill., urged a need for better public relations in the heating and air-conditioning field. Mr. Nessell then related the various experiences he encountered during the testing of 22 air-conditioned homes in Austin, Tex. The research reported on by Mr. Nessell was carried on during 9 weeks of testing of these houses with their various systems to determine what the air conditioning was doing inside each house. • • • A member of the ONTARIO Chapter, W. L. Rootham, assistant sales manager, Johnson Temperature Regulating Company of Canada, Ltd., Toronto, Ont., spoke to his fellow members on the *Analysis of Control Centers.* Mr. Rootham's talk was ably presented. • • • D. D. Wile, chief engineer, Recold Corp., Los Angeles, Calif., discussed control methods for air-conditioning systems at meetings of both the SOUTH TEXAS and SOUTHWEST TEXAS Chapters. • • • The entire discussion at a WASHINGTON, D.C., Chapter meeting was received with enthusiasm. *Fan Selection* was the

John R. Allen Memorial Library

The ASHAE Committee on Research gratefully acknowledges the following gifts to the John R. Allen Memorial Library, which is maintained at the Society's Research Laboratory, 7218 Euclid Ave., Cleveland 3, Ohio.

A Guide to Current Practice, 1955. Compiled by the Guide Committee of the *Institution of Heating and Ventilating Engineers,* London, England. Gift of the Institution.

The Proceedings of the Institution of Mechanical Engineers, Vol. 169, 1955. Gift of the Institution, London, England.

The Proceedings of the Automobile Division of the Institution of Mechanical Engineers, 1954-55. Gift of the Institution, London, England.

The presentation of textbooks and pamphlets in the field of heating, ventilating and air conditioning and allied fields, by authors and others, will be welcomed by this library. Suitable book plates carry the name of the donor and date of the gift.

subject of a talk by R. Jorgensen. • • • WESTERN MASSACHUSETTS Chapter scheduled several interesting talks at recent meetings. Stanley Williams, Pittsfield General Electric Plant, spoke on *Automation* in the office and in the factory. The principles, design and installation of radiant ceiling panel heating were described by J. Kohler and Mr. Partington, Burgess-Manning Co., Chicago, Ill. Max Tappero, New England manager, Janitrol Division, Surface Combustion Corp., discussed the application of unit heaters in commercial and industrial heating systems, and J. W. Bennett, chief engineer, Western Massachusetts Electric Co., treated *Atomic Energy in Electric Power*. • • • During a WESTERN MICHIGAN Chapter meeting, Peter Van Dae, district manager, Barber-Colman Co., Atlanta, Ga., addressed the audience on *High Velocity Air Distribution for Heating and Cooling.* His presentation covered the features, design and installation of high velocity systems. • • • G. F. Carlson, engineer, Bell & Gossett Co., Morton Grove, Ill., gave an informative talk on hot water heating systems at a WISCONSIN Chapter meeting. He stressed the advisability of using standard pumps wherever possible and demonstrated the small effect which a slight variation in characteristics could actually have on a heating installation.

Non-technical Programs

A Ladies Night was held by the EMPIRE STATE CAPITAL Chapter. • • • At the first regular meeting of the FORT WORTH Chapter the members listened to President Eisenhower's address on the Suez crisis. • • • Two speakers at an ILLINOIS Chapter meeting were William Twine, Zurich Insurance Co., and James Liska, Marsh & McLennan, Inc. Mr. Twine's talk concerned the importance of safety precautions for the prevention of industrial accidents, and he offered specific suggestions in regard to reducing the number of accidents. This speaker further stressed the need to avoid falling material on construction jobs. The second speaker, Mr. Liska, then answered a number of varied questions from the floor, related to insurance problems which are typical in this industry. • • • F. W. Jenkinson presented the Spokane Scottish Bagpipers and Sword Dancers as entertainment at an INLAND EMPIRE Chapter meeting. They received considerable applause. • • • Ninety members and guests of the WESTERN MICHIGAN Chapter enjoyed an afternoon of golfing, boating, fly casting and other activities. A smorgasbord style dinner was served in the evening. The meeting was concluded with the induction of officers, conducted by S. M. Paganelli, former president and member of the board of governors.

Puget Sound Old Timers Meeting

PUGET SOUND (formerly Pacific Northwest) Chapter held a meeting on May 14 in honor of its past presidents and *old timers.* Pres. L. F. Christofferson introduced the 17 past presidents who were present: P. I. L. Winsor, 1955-56; T. C. Caskey, 1954-55; H. T. Orebaugh, 1953-54; R. M. Stern, 1951-52; C. A. Pangborn, 1950-51; J. D. Sparks, 1949-50; E. H. Langdon, 1947-48; R. E. LeRiche, 1946-47; R. D. Morse, 1943-44; H. T. Griffith, 1942-43; R. O. Wesley, 1939-40; C. W. May, 1938-39; S. D. Peterson, 1936-37; Lincoln Bouillon, 1935-36; W. E. Beggs, 1931-32; E. O. Eastwood, 1930-31; and E. L. Weber, 1929-30.

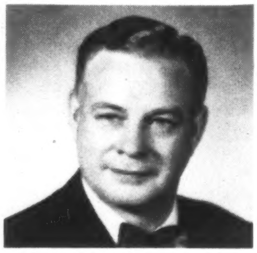
A few remarks were made by each of the past presidents as they were introduced. Past President Weber asked for a moment of silence which was observed in honor of the late W. Lyle Dudley and C. F. Twist, two of the first five presidents of the chapter.

CONTRACTORS AWARD TO FITTS

President P. B. Gordon (left) presents the 1957 contractors annual service award to Joseph C. Fitts. The ceremony took place at the convention of the *Mechanical Contractors Association of America* at Miami Beach.

Elections and Appointments

New officers elected for the ARIZONA Chapter are *President*—E. P. Boothroyd; *Vice President*—F. W. Gabbard; *Secretary*—G. L. Jackson, Jr.; and *Treasurer*—L. A. Byron, Jr. • • • Pres. J. F. Naylor, Jr., BATON ROUGE Chapter, appointed a nominating committee, consisting of R. T. Collier and T. G. Neff, with J. L. Webb as chairman. Later, E. C. Frederick was selected as a substitute for Mr. Neff. President Naylor also appointed a committee to make arrangements for a dinner party in connection with the installation meeting. Members who will cover the project are Mr. Frederick, Mr. Collier, and R. F. Dupuy. Officers who were elected for 1957-58 are *President*—A. W. Holland; *Vice President*—W. J. LeBlanc; *Secretary*—J. P. Jones; *Treasurer*—R. F. Dupuy; *Board of Governors*—F. D. Beaullieu, III, and A. J. Mayers, Jr. • • • Selected to serve the EMPIRE STATE CAPITAL Chapter were *President*—H. F. Kruger; *1st Vice President*—E. J. Mahoney; *2nd Vice President*—M. E. Waddell; *Secretary-Treasurer*—B. E. Mullen; *Board of Governors*—N. J. Ireland and Leonard Levine. • • • Committee chairmen were appointed for the FORT WORTH Chapter as follows: *Program*—Harry Cohn; *Membership*—S. T. Lake, Jr.; *Publicity*—H. E. Cunningham; *Attendance*—W. C. Weeden; and *Hospitality*—J. L. Tye. • • • The report of the tellers of election of ILLINOIS Chapter was as follows: *President*—Harvey E. Anderson; *Vice President*—Herbert Kreisman; *Secretary*—J. C. Scott; *Treasurer*—E. P. Heckel, Jr.; *Board of Governors*—J. H. Stiggleman, L. O. Paul and F. A. Balzer. • • • G. J. Kraai, a member of the board of governors, IOWA Chapter, announced the auditing committee as follows: R. R. Schilling, J. R. Bain and G. G. Gunderson. • • • Leadership of the MINNESOTA Chapter was turned over to Fred Vogt by Pres. E. T. Erickson.



H. E. Anderson
Newly Elected Illinois President

The new president named the following members as committee chairmen for the coming year: *Program*—J. H. Jester; *House*—J. V. Borry; *Attendance*—C. T. Olson; *Exchanger*—T. R. Turnham, and *Assistant*—C. B. Ashenfelter; *Auditing*—J. F. Siegel; *Entertainment*—F. W. Legler; *Publicity*—W. J. Ortman; *Refreshment*—T. A. Ryan; *Budget*—O. L. Lilja; *Roster*—J. L. Skarnes; *Planning*—E. F. Snyder, Jr., A. B. Algren and William Sturm; and *Membership*—C. T. Hastings. • • • A nominating committee, consisting of B. L. Palmer, as chairman, C. M. Stevens and Burt Lomax, Jr., was appointed by Pres. J. W. Doggett, Jr., MISSISSIPPI Chapter. • • • N. P. Gunter, of NEW MEXICO Chapter's ballot committee, reported the election results: *President*—J. K. James; *Vice President*—F. H. Bridgers; *Secretary*—G. F. Ard; *Treasurer*—E. L. Brazier, Jr., *Board of Governors*—W. L. Beale, J. R. Dion and E. T. Kryfko. • • • Two NORTHEASTERN OKLAHOMA Chapter committees were appointed: W. M. Melton, Jr., L. B. Bury and J. R. Moore were named as a committee to examine the chapter books. Selected to serve as tellers for the election of officers were F. M. Thomas, W. C. Buckner and L. A. Ives. • • • Secy. R. D. Wilson, NORTHERN OHIO Chapter, was instructed to cast a unanimous ballot for the slate of officers: *President*—R. E. Leising; *Vice President*—R. A. Urban; *Secretary*—J. F. Koran; *Treasurer*—B. A. Schwirtz; *Board of Governors*—H. R. Canoyer and Mr. Wilson. • • • Election scrutineers chosen by Pres. C. J. Bootes, ONTARIO Chapter, were W. J. Blackhall, R. B. Campbell and H. T. Carter. Officers selected by vote were: *President*—C. L. Torry; *Vice President*—Jack Thompson; *Secretary-Treasurer*—H. R. Roth; *Board of Governors*—R. A. Ritchie, Ernest Fox, J. D. Coates and C. J. Bootes. • • • J. S. Miller, PUGET SOUND Chapter, reported for the tellers of election that the following officers for 1957-58 had been elected unanimously: *President*—E. W. Triol; *1st Vice President*—M. W. McKinstry; *2nd Vice President*—H. M. Hendrickson; *Secretary*—R. H. Liniger; *Treasurer*—K. G. Massart; *Board of Governors*—E. T. Franklin, Jr., and D. M. Hopkins. C. A. Linde and T. C. Langdon served with Mr. Miller as tellers, appointed by Pres. L. F. Christofferson. • • • TOLEDO Chapter unanimously elected their slate of officers as follows: *President*—Robert Greenwald; *Vice President*—D. L. Wilson; *Secretary*—G. R. Munger; *Treasurer*—J. E. Wilkie; *Board of Governors*—M. D. Williams, E. J. Katafiasz and J. P. Eyster. • • • A Nominating Committee, consisting of W. C. Grady, T. P. Loring and L. C. Latimer, Jr., was selected by the WESTERN MASSACHUSETTS Chapter. • • • G. L. Jepson was named chairman of WESTERN MICHIGAN Chapter's tellers committee. Mr. Jepson declared the following officers elected: *President*—B. J. Walter; *Vice President*—R. J. Waalkes; *Secretary*—S. R. Curtis; *Treasurer*—F. K. Platt; *Board of Governors*—F. L. Murray, W. C. Harrower and P. S. Morton. • • • Election results announced by WESTERN NEW YORK Chapter were as follows: *President*—G. E. Kuhn; *1st Vice President*—J. P. Guerra; *2nd Vice President*—J. F. Bedard; *Secretary*—D. J. Seifert; *Treasurer*—M. C. Beman; *Board of Governors*—V. N. Harwood, Roswell Farnham, Joseph Davis, C. W. Stone and Q. P. Thompson. • • • P. F. Brinen, W. T. Holland and W. R. Wendt, Jr., were appointed as tellers to count the ballots for the new officers for the WISCONSIN Chapter. Wisconsin Chapter will be served by: *President*—H. W. Alyea; *Vice President*—R. D. Rodwell; *Treasurer*—H. W. Snyder; *Secretary*—A. A. Stutheit; *Board of Governors*—C. E. Melcher and B. M. Kluge. • • • Officers for the 1957-58 school year for NORTH CAROLINA STATE COLLEGE Student Branch will be: *President*—M. K. Sloan; *Vice President*—J. A. Fields; *Treasurer*—R. J. Parker; *Secretary*—C. J. Griswold; *Reporter*—E. A. Pace; and *Engineering Council Representative*—J. W. Lowry, Jr. H. A. Blount, Jr., was appointed as chairman of the committee for the annual picnic. • • • The new officers for PURDUE UNIVERSITY Student Branch will be: *President*—J. D. Faris; *Secretary*—D. C. Robinson; *Coordinatot*—R. J. Birkholz.

Flink Honored by New York Chapter

Carl H. Flink, technical secretary of the Society, was honored at the May meeting of the New York Chapter, for which he was first named secretary in 1944. Albert Giannini, a past president of the chapter, made a surprise presentation of a gold wristwatch to Mr. Flink, who is retiring as chapter secretary after 13 years of service. This presentation was a gift from all the past chapter presidents under whom Mr. Flink has served.

Student Activities

A broad treatment of *Shooting Service on Thermostatic Expansion Valves* was presented before the NORTH CAROLINA STATE COLLEGE Student Branch. The speaker for the evening was D. M. Lawson, sales engineer, Sporlan Valve Co., Atlanta, Ga. The talk was well prepared and was supplemented by the use of color slides. • • • Members of the PURDUE UNIVERSITY Student Branch toured Eli Lilly & Co., Indianapolis, Ind. After being welcomed by J. P. Gibbons, project engineer, those attending were subdivided into small groups which were guided through the plant by members of the engineering staff. They were shown the various methods and equipment used in the control of temperature and humidity for the manufacture of pharmaceutical products. • • • Following attendance at a meeting of the parent Indiana Chapter, Purdue University Student Branch members viewed the newly installed heating and air-conditioning system of the Citizens Gas Co., Indianapolis. • • • The Purdue students also enjoyed a picnic dinner at the residence of Prof. F. B. Morse, faculty advisor.

Personals

A past president's pin was given to G. G. Davis at an EMPIRE STATE CAPITAL Chapter meeting. The presentation was made by L. V. Appleby. • • • Pres. H. G. Gragg, ILLINOIS Chapter president, presented a desk pen set to P. J. Marschall in appreciation for his work as general chairman of the Committee on Arrangements for the Society's 63rd Annual Meeting, which was held in Chicago. Mr. Marschall is a member of Council and regional director, Regional Area 2. Mr. Marschall's secretary also was presented a fountain pen in appreciation for her services. • • • At another meeting, Illinois President Gragg received his past president's pin from the incoming president, Harvey E. Anderson. • • • H. U. Wright reported to the INLAND EMPIRE Chapter on the results of chapter participation in the judging of the Inland Empire Science Fair. K. M. Wood, a past-master, judged in this affair. A round of applause was given to J. A. Doyle, member, and Max Tonn, alternate member, Chapters Regional Committee, for their excellent representation of the chapter at the regional meeting. • • • Following the installation of officers for the Inland Empire Chapter, the new president, J. A. Doyle, presented to the retiring president, Max Tonn, a barometer and thermometer attractively mounted in wood. • • • The retiring president of the KANSAS CITY Chapter, R. M. Spencer, received his past president's certificate and pin from S. C. McCann, president elect. President McCann made an excellent acceptance speech. • • • A Life Membership certificate was tendered to David Caleb, Kansas City Chapter, by P. B. Gordon, Society president, who was in attendance at the Chapter meeting in connection with the regional meeting. • • • At a meeting of the NEW YORK Chapter, Pres. J. B. Hewett, announced that H. B. Hedges and W. J. Osborn, who

P. J. Marschall
Annual Meeting Chairman Honored

Journal Section

had become Life Members of ASHAE, were now named Life Members of the chapter. President Hewett introduced Clifford Wojan, professor, Polytechnic Institute of Brooklyn, who had been invited as a guest of the chapter. • • • Following introduction of the new officers of the New York Chapter, Pres. J. B. Hewett presented the gavel to the incoming president, C. R. Hiers. P. B. Gordon, Society president, presented a plaque to the outgoing president in recognition of Mr. Hewett's service to the chapter during his term of office. • • • Pres. G. H. Meffert, NORTH TEXAS Chapter, read a letter from Reg. F. Taylor expressing appreciation for his honorary membership in the chapter. • • • President-elect C. L. Torry, ONTARIO Chapter, presented the outgoing president, C. J. Bootes, with a past president's certificate and emblem. These were given with the best wishes of the chapter in appreciation for a highly successful term in office. • • • Announcing a correction in chapter minutes, Pres. W. B. Hayes, OREGON Chapter, listed the membership of the legislative committee as K. H. Hanson, G. G. Van Alst and Ed Lokey, with H. W. McKenzie as chairman. He also announced that the chapter will be represented in the Oregon Technical Society by T. E. Taylor (2 years), O. T. Jacobson (1 year), with Mr. McKenzie and R. L. Schroeder as alternates. • • • R. M. Toucey, retiring as president of the PITTSBURGH Chapter, received his past president's pin from the new president, E. H. Riesmeyer, Jr. • • • At a PUGET SOUND Chapter meeting, E. O. Eastwood delivered an address in honor of W. E. Beggs and presented him with a certificate of Life Membership in ASHAE. The certificate was accepted by Mr. Beggs with deep gratitude. • • • Pres. L. F. Christofferson, retiring as president of the Puget Sound Chapter, thanked the other officers and members for their support during the past year, and turned the gavel over to the new president, E. W. Triol. As his first act, the new president pinned Mr. Christofferson with a past president's emblem. Past Pres. T. C. Caskey gave President Triol the chapter charter for safekeeping. • • • A vote of appreciation for his work on the stag party was given to R. F. Williams, Jr. Pres. J. C. Lewis also expressed the appreciation of SOUTH TEXAS Chapter to all the other members who worked on the committee. • • • The president of TOLEDO Chapter, J. F. Guest, praised the work of their nominating committee, under the chairmanship of F. A. Edgington. • • • Toledo Chapter members who are serving on technical advisory committees of the Society were called upon to briefly describe their work. G. A. Kelley is serving on the TAC on Sorption, and G. R. Munger is a member of the TAC on Heating and Air Conditioning Loads. • • • At a recent meeting of the WESTERN NEW YORK Chapter, R. D. Madison received his Life Membership certificate. • • • Pres. V. N. Harwood, Western New York Chapter, thanked the membership for their cooperation during the past year, especially mentioning G. E. Kuhn, program chairman; J. P. Guerra, membership chairman; F. R. Collins, Jr., reception chairman; and Robert Jorgensen, publicity chairman; all of whom did outstanding jobs. Incoming President Kuhn made the presentation of the past president's certificate to Mr. Harwood. • • • P. F. Brinen, W. T. Holland and W. R. Wendt, Jr., were appointed as tellers to count the ballots for the new officers and board of governors of the WISCONSIN Chapter. After the election, H. W. Alyea, the newly elected president, thanked the retiring president, H. K. Forfar, for his untiring efforts on behalf of the Society, and completed the ceremony with the past president's pin presentation. • • • For his continual devotion shown and unexcelled work contributed to the PURDUE UNIVERSITY Student Branch, Prof. F. B. Morse, faculty advisor, received a gift of golf balls, offered by the student branch president, G. T. Dollas. • • • The recipient of the W. T. Miller award, for the outstanding student member of the Purdue group, was G. T. Vail, Jr., graduating senior and retiring secretary-treasurer of the student branch. Honorary mention was given to R. F. Jackson and John Evans. Both received a library of books, related to the heating and air-conditioning field, contributed by members of the Indiana parent chapter. • • • A set of volumes was donated to the Purdue University Student Branch by G. J. Hayes, in memory of his father, Joseph G. Hayes.

GORDON MEETS WITH EJC DIRECTORS

In his capacity as Society representative, Pres. P. B. Gordon, New York, N. Y., attended the regular meeting of the Board of Directors of *Engineers Joint Council* in New York on April 23rd.

BUILDING EXHIBITION — LONDON — 1957

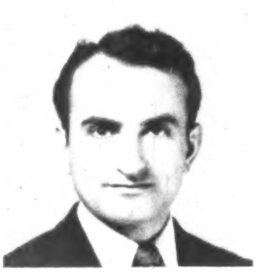
The long-established Building Exhibition at Olympia, London, will hold its 50th exhibition there from November 13-27, 1957. Overseas visitors, including Americans, are cordially invited to attend and become acquainted with the very large displays of British building products including heating equipment.

DR. OZISIK JOINS ASHAE LABORATORY STAFF

It is announced that Dr. Necati Ozisik from Ankara, Turkey has joined the Laboratory staff in Cleveland. Dr. Ozisik undertook his new duties shortly after his arrival in the United States in April. Among his duties at the Laboratory, it is expected that he will conduct research on the problems of heat transfer.

Dr. Ozisik brings to the Laboratory staff a broad background of education and practical work both in England and in his native Turkey.

He began his university studies at the Technical University of Istanbul, and he is a graduate of London University. From the faculty of engineering of the Queen Mary College of the University of London, he received his B.S. degree in 1947; and after carrying out a research project on the subject of heat transfer for DSIR of England, he received his Ph.D. (London) degree in 1949. The F. Bernard Hall prize was awarded by the *Institution of Mechanical Engineers of England* for his joint paper on an investigation into the condensation of steam.


Dr. Necati Ozisik
Cleveland, Ohio

In England he worked with the Davy-Paxman, Ltd. and Ruston Hornsby, Ltd.

He served his military service in 1951 as reserve lieutenant at the Turkish General Staffs in Turkey. After demobilization, he took up a position as industrial analyst at FOA (then ICA) of the United States in Ankara. His work there comprised of an investigation into the efficient utilization of fuel in Turkish industry.

In 1953 he took up a post as consultant engineer at the ET ve Balik Kurumu General Directorate in Ankara (the state-sponsored organization in Turkey which constructs and operates the state-owned refrigeration industries) to advise on the problems of heat transfer in the cold industry and in the planning of the refrigeration plants. In 1955 he was assigned as the director of the technical section of the ET ve Balik Kurumu.

Through the technical assistance program of the United Nations he went on a study tour in Europe for investigating the development of refrigeration industries in those countries.

WARM AIR SUMMER CONVENTION AT SAN FRANCISCO

The summer convention of *National Warm Air Heating and Air Conditioning Association* took place on June 5, 6 and 7 with Hotel Fairmont in San Francisco as headquarters.

Society members took an active part in this three-day convention. Included on the program were, C. M. Barnes, Chicago, Ill.; E. E. Carroll, Portland, Ore.; J. F. Deane, San Francisco, Calif.; H. T. Gilkey, Cleveland, Ohio; D. M. Keefer, Portland, Ore.; N. N. Leas, Fresno, Calif.; F. L. Meyer, Peoria, Ill.; C. W. Nessell, Minneapolis, Minn.; F. J. Nunlist, Jr., Milwaukee, Wis., and D. S. Will, Long Beach, Calif.

SPITZLEY HEADS CONTRACTORS

J. H. Spitzley, Detroit, Mich., a Society member, was made president of the *Mechanical Contractors Association of America* at their annual convention in Miami in May.

J. H. Spitzley
Detroit, Mich.

Mr. Spitzley is president and general manager of R. L. Spitzley Heating Co. In addition to membership in the Society, he is also a member of the Detroit Board of Commerce, The Detroit Club, The Detroit Athletic Club, Rotary, The Grosse Pointe Yacht Club and the Country Club of Detroit.

Mr. Spitzley has been associated with the Spitzley firm throughout his business career, except for a 3-year tour of duty with the Navy.

CONFERENCE ON ENGINEERING EDUCATION

The *Western Society of Engineers* is reported as being prepared to provide local sponsorship in Chicago for a comprehensive conference on the fundamental status of higher education in relation to engineering, science and technology. The meeting is to be held at the Edgewater Beach Hotel in Chicago, October 31-November 2, 1957. Among the sponsors of the conference is the *Engineers Joint Council*, of which the Society is a member.

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Members of ASHAE
Moved or Moving?

Each month mail is returned BECAUSE you overlooked advising us of the change in your address.

The return mail is a loss to you, and an added expense to the Society.

In your own interest, will you please advise us at once of any change in your business or home address, indicating which is your mailing address.

ASHAE Headquarters
62 Worth St.
New York 13, N. Y.

TEXAS CONSULTING FIRMS MERGE

Two of Texas' best known consulting engineering firms have merged. They are H. E. Bovay, Jr., consulting engineers, and Reg. F. Taylor, consulting engineer. The Bovay firm name will be retained.

The merger is of more than usual interest to Society members since Reg. F. Taylor, Houston, Tex., H. E. Bovay, Jr., Houston, Tex., and W. N. Pauley, Spokane, Wash., are all principals in the firms.

The merger is in keeping with the trend of the profession toward larger, more fully integrated firms, capable of handling complete projects.

Mr. Taylor is dean of the air-conditioning engineers of the South and is past president of the Society and has also headed both the North and South Texas Chapters.

Mr. Bovay is a past president of San Jacinto Chapter, *Texas Society of Professional Engineers*, and has been active in state and national groups of that society.

Mr. Pauley has been author of various professional papers and has also spoken before various ASHAE chapters.

Mr. Taylor will serve as engineering consultant in the new organization and his staff will become part of the Bovay staff with headquarters at 5009 Caroline St. in Houston. The Bovay organization with branches in Spokane, Wash., and Baton Rouge, La. has between 170 and 180 employees.

The merged firm plans to continue offering engineering services on major projects for civilian as well as for governmental agencies.

JOINT *OHIA*-ASHAE RESEARCH PROJECT

A feature of the 35th annual convention of the *Oil Heat Institute of America*, in Boston, June 3-6, 1957, was the Technical Division Symposium on Domestic Oil Heating and Cooling held on June 4.

A. A. Putnam of Battelle Memorial Institute reviewed the progress made to date with regard to oil-burning equipment in a joint research project sponsored by *OHIA*, *A.G.A.* and ASHAE to discover the cause and cure of pulsations in residential heating equipment.

A paper on this subject was presented at the ASHAE Annual Meeting in Chicago in February 1957. A second paper was presented during the Semi-Annual Meeting at Murray Bay.

Other papers presented at the symposium covered oil-fired year-round air conditioners, quality of heating oil, handling of domestic heating oil, field testing for improvements in home heating equipment and oil burning servicing.

CANDIDATES FOR MEMBERSHIP

Listed here are the names of 161 men who are candidates for membership or advancement in membership grade.

Members are requested to assume their full share of responsibility of receiving these candidates into membership by advising the Executive Secretary before July 31, 1957, of any whose eligibility for membership is questioned. Unless such objection is made these candidates will be voted upon by the Council.

Note: **Advancement* †*Reinstatement*

Arizona (*Region* 4)

MAGGS, ALFRED, Engr., Arizona York Refrigeration Co., Phoenix.

California (*Region* 4)

HUSSAIN, M. I. M., Application Engr., Holly Manufacturing Co., Pasadena.
KONFAL, R. C., Sales Engr., E. L. Payne Heating Co., Beverly Hills.
OLIPHANT, K. S., Cons. Engr., Kenward S. Oliphant, San Francisco.
PAGET, C. H., Estimator, Frank M. Booth, Inc., Marysville.
TIMPSON, R. F., Proj. & Mech. Engr., Donald R. Warren Co., Los Angeles.
TOWNSEND, R. M., Mgr., Htg. & A-C. Div., A. O. Reed & Co., San Diego.

Colorado (*Region* 3)

BURKE, J. C., JR., Chief Engr., Tracy-Behrent Engineering Co., Denver.

Connecticut (*Region* 1)

MENKUS, MILTON, Cons. Engr., M. Menkus, Norfolk.
ROEDEL, P. O., JR., Repr., The Wiremold Co., Hartford.

District of Columbia (*Region* 5)

SMITH, J. R., Estimator, John G. Webster & Sons, Inc., Washington.

Florida (*Region* 5)

AYERS, J. E., Repr., Noland Co., Inc., Jacksonville.
BALLENTINE, A. P., Engr., Florida Air Conditioners, Inc., Jacksonville.
BARWELL, F. A., JR., Estimator, Florida Weathermakers, Inc., Jacksonville.
BECKWITH, J. D., Installation, Henley and Beckwith, Inc., Jacksonville.
BROWN, C. E., Sales Engr., North Florida Air Conditioning, Inc., Jacksonville.
BUCK, C. R., JR., Chief Engr., Florida Weathermakers, Inc., Jacksonville.
BYRD, R. T., JR., Pres., North Florida Air Conditioning, Inc., Jacksonville.
CAMPBELL, GRANT, Pres., Grant Campbell, Inc., Jacksonville.
CERNI, E. M., Cons. Engr., The Thermodyne Corp., Jacksonville.
COHN, L. L., Sales Engr., Florida Air Control Co., Jacksonville.
DOWLING, W. H., JR., Vice Pres., H. L. McMurry & Co., Jacksonville.
FENNEL, R. F., Pres., Miller-Fennel Air Conditioning Corp., Jacksonville.
FOGG, J. H.†, Repr., H. L. McMurry & Co., Jacksonville.

Gay, W. W., Estimator, Henley & Beckwith, Inc., Jacksonville.
Greelish, R. S., Pres., Roy S. Greelish & Co., Inc., Jacksonville.
Griffo, F. P., Vice Pres., Alderman Park, Inc., Jacksonville.
Hammond, J. M., Cons. Engr., James M. Hammond, Jacksonville.
Haramis, L. E., Engr., Reynolds, Smith and Hill, Jacksonville.
Head, H. A., Jr., Head, Mech. Dept., Beiswenger-Hoch & Assocs., Jacksonville.
Holborn, H. A., Chief Engr., Henley & Beckwith, Inc., Jacksonville.
Kelly, S. D., Estimator, Florida Weathermakers, Inc., Jacksonville.
Kelly, V. A., Pres. & Treas., Florida Weathermakers, Inc., Jacksonville.
Kimball, H. O., Repr., H. L. McMurry & Co., Jacksonville.
Liphart, C. H., Jr., Partner, Charles H. Liphart & Son, Jacksonville.
Matthews, H. B., Engr., Merrill-York, Jacksonville.
McLeod, H. B., Repr., Roy S. Greelish & Co., Inc., Jacksonville.
McMillan, W. W., Pres., McMillan Comfortaire Heat Pumps, Inc., Jacksonville.
Minick, W. D., Chief Engr., Florida Air Conditioners, Inc., Jacksonville.
Moller, M. W., Pres., The Thermodyne Corp., Jacksonville.
Mulligan, R. C., Repr., Johns-Manville Sales Corp., Jacksonville.
Myers, R. M., Sales Engr., Hairston and Co., Jacksonville.
Oakley, K. W., Sales Engr., North Florida Air Conditioning, Jacksonville.
Peck, R. K., Jr., Vice Pres. in charge of Engrg., McMillan Comfortaire Heat Pumps Inc., Jacksonville.
Register, G. R., Partner, Haas, Register, Cummings & Hutchinson, Jacksonville.
Seibert, E. W.†, Mfrs. Repr., Earl W. Seibert, Ponte Vedra Beach.
Sheppard, H. E., Dist. Mgr., American Blower Corp., Jacksonville.
Taylor, W. H., Partner, Van Wagenen, Taylor & Van Wagenen, Jacksonville.
Thielke, Walter, Partner, VanDusen-Pooley-Assocs., Jacksonville.
Van Landingham, J. C., Pres., Florida Air Conditioners, Inc., Jacksonville.
Van Wagenen, W. C.*, Partner, Van Wagenen, Taylor & Van Wagenen, Jacksonville.
Warren, R. E., Partner, Tribble, Lee & Warren, Jacksonville.
Yantiss, C. J., Estimating Engr., Henley & Beckwith, Inc., Jacksonville.

Georgia (*Region* 5)

Gray, J. J., Jr., Owner, Gray's Refrigeration Co., Brunswick.
Mock, W. H. Partner, Mock Plumbing Co., Savannah.

Illinois (*Region* 2)

Anderson, C. M., Pres. & Owner, Anderson Refrigeration & Heating, Oak Lawn.
Feuille, Fred, Dist. Engr., Bete Laboratories, Inc., Chicago.
McNamara, T. J., Chief Engr., Refrigeration Maintenance Corp., Chicago.
Wyatt, G. A.†, Asst. Vice Pres., Mehring & Hanson Co., Chicago.

Indiana (*Region* 2)

Carlisle, Zane, Prod. Engr., All Year Air Conditioning Div., Servel, Inc., Evansville.
Gibbons, J. P., Proj. Engr., Eli Lilly & Co., Indianapolis.
Mahorney, T. E., Design Draftsman, Eli Lilly & Co., Indianapolis.

Iowa (*Region* 3)

Johnson, F. G., Repr., Century Engineering Corp., Cedar Rapids.

Kansas (*Region* 3)

Blazier, W. E., Jr., Research Engr., The Coleman Co., Inc., Wichita.
Swanson, H. C., Mech. Engr., Servis, Van Doren & Hazard, Topeka.
Thamposh, F. H., Design Engr., Robert R. Bayles & Assocs., Mission.
Wilcox, E. F., Mfrs. Repr., Mission.

Kentucky (*Region* 5)

Miller, A. T., Jr., Dist. Sales Mgr., Air Filter Dept., American Air Filter Co., Inc., Louisville.

Louisiana (*Region* 5)

Armstrong, W. S., Mgr., Southern Div., United Cork Companies, New Orleans.
Ewing, M. B., Vice Pres. & Mgr., Air Conditioning Appliance Corp., Alexandria.
Lotz, F. H., Jr., Mech. Engr., Cary B. Gamble & Assocs., New Orleans.

Maryland (*Region* 5)

Esrig, Harold, Mech. Designer, McNeill & Baldwin, Baltimore.
Norton, J. D., Jr., Repr., York Corp., Baltimore.

Massachusetts (*Region* 1)

Easton, R. M., Treas., Allied Wholesale Heating Co., Inc., Brockton.

Michigan (*Region* 2)

Tauber, R. L., Mech. Engr., Austin Engineers, Inc., Detroit.
Wright, R. N., Mech. Engr., Dept. of Administration, Property Management, State of Michigan, Lansing.

Minnesota (*Region* 3)

Lindberg, C. P., Mech. Engr., Ellerbe & Co., St. Paul.

Mississippi (*Region* 5)

Beach, J. A., Jr.*, Utilization Engr., United Gas Corp., Gulfport.
Peterson, Jinx, Mgr., Refrig. Dept., Mississippi Hardware Co., Vicksburg.

Missouri (*Region* 3)

Baker, W. R., Estimator, Interstate Heating & Plumbing Co., Kansas City.
Daugherty, J. E., Mech. Engr., William L. Cassell, Mech. Engr., Kansas City.
Gorman, R. J., Owner, Engineered Equipment Co., Kansas City.
Halpin, W. F., Jr., Asst. to Projects Supvsr., McNamara Equipment Co., St. Louis.
Jacobson, E. L.*, Vice Pres., A. D. Jacobson Plumbing and Heating Co., Inc., Kansas City.
Love, N. M., Jr., Mfrs. Repr., Friemel-Love Co., Clayton.
Sherrer, J. R., Jr.†, Sales Engr., General Heating & Cooling Co., Kansas City.
Smith, H. W., Mech. Engr., William L. Cassell, Mech. Engr., Kansas City.
Smith, R. E., Engr., William L. Cassell, Mech. Engr., Kansas City.
Thompson, E. M., Mfrs. Repr., Kansas City.
Volek, F. J., Chief Engr., Hewitt & Royer, Kansas City.

New Jersey (*Region* 1)

Andrews, J. C., Sales Engr., Sarco Co., Inc., Newark.
Dorian, L. J., Mgr., Butler Supply Co., Riverdale.
Sage, R. W., Section Head, Process Research Div., Esso Research & Engineering Co., Linden.
Weeks, R. L., Asst. Dir., Esso Research & Engineering Co., Linden.

New York (*Region* 1)

Boynton, J. H., Tech. Sales, Owens-Corning Fiberglas Corp., New York.
Engle, P. M., Jr., Mgr., Research & Dvlpt., Cambridge Filter Corp., Syracuse.
Kallen, H. P., Assoc. Editor, *Power Magazine*, McGraw-Hill Publishing Co., New York.
Katz, W. J., Design & Project Engr., A.R.P. Refrigeration Co., Inc., Brooklyn.
Kistler, R. L., Sales Engr., Clarage Fan Co., Rochester.
Knecht, A. W., III, Design Engr., Seelye Stevenson Value & Knecht, New York.
Miller, C. B., Chief of Htg., Vtg. & A-C. Section, Allied Processes, New York.
Moffett, W. G., Dist. Sales Engr., Pennsylvania Furnace & Iron Co., New Hartford.
Roos, E. B. J.*, Partner, Seelye Stevenson Value & Knecht, New York.
Salinsky, J. L., Htg. & A-C. Engr., Sargent, Webster-Crenshaw & Folley, Syracuse.
Zonino, J. D., Sales Mgr., Fedders-Quigan Corp., Maspeth

Ohio (*Region* 2)

Bradford, W. L., Sales Engr., Westinghouse Electric Corp., Sturtevant Div., Cincinnati.
Calafato, J. S., Sr. Technician, The East Ohio Gas Co., Cleveland.
Craun, J. M., Pres., The Craun-Liebing Co., Cleveland.
Curtis, W. A., Mgr., Fan & Blower Div., The Peerless Electric Co., Warren.
Frick, W. H., Sr. Technician, The East Ohio Gas Co., Cleveland.
Grant, C. W., Technician, The East Ohio Gas Co., Cleveland.
Guenther, D. M., Estimator, Henry Niemes, Inc., Cincinnati.
Pandy, E. S., Asst. Sales Mgr., Ric-wiL, Inc., Barberton.
Richardson, E. L., Sr. Technician, The East Ohio Gas Co., Cleveland.
Roberts, Raymond, Gen. Supt., Feldman Bros. Co., Cleveland.
Sackl, J. M., Repr., Cleveland Electric Illuminating Co., Cleveland.
Stoneking, C. W., Mgr., Refrig. Dept., Williams & Co., Toledo.
Walter, R. E., Sales Engr., American Blower Corp., Cleveland.
Wentz, R. L., Project Engr., Armstrong Furnace Co., Columbus.
Winslow, Albert, Chief Engr., The Halle Brothers Co., Cleveland.

Oklahoma (*Region* 6)

Hayes, D. R., Sales Engr., Mideke Supply Co., Oklahoma City.
Holden, R. F., Owner, R. F. Holden Co., Oklahoma City.
Lynn, H. D., Sales Mgr., Waugh Brothers Supply Co., Oklahoma City.
Robinson, R. D., Sales Engr., The Gasteam Radiator Co., Inc., Oklahoma City.
Stoll, R. J.*, Mech. Consultant, Paul Harris, Archt., Oklahoma City.
Wilson, G. W., Pres., The Gasteam Radiator Co., Inc., Oklahoma City.

Oregon (*Region* 4)

Amell, C. H., Repr., Kleenair Products Co., Portland.
Matheson, J. S.*, Mech. Designer, Campbell-Norquist & Co., Portland.

Pennsylvania (*Region* 1)

Engelbrink, J. U., Mgr., Htg. & Standard Products Divs., C. H. Wheeler Manufacturing Co., Philadelphia.
Fleming, J. F., Sales Engr., Busch Co., Pittsburgh.
Popyk, W. W., Mgr., Engrg. Service, National U.S. Radiator Corp., Johnstown.

Tennessee (*Region* 5)

Barbour, T. J., Assoc., C. W. Dean & Assoc., Memphis.

Texas (*Region* 6)

Burley, Billy, Chief Engr., Beatty Engineering Co., Dallas.
McCormick, W. J., Assoc., Leo L. Landauer & Assocs., Inc., Dallas.
Nunley, K. H., Owner, Comfort Engineering Co., Inc., Odessa.
Sackett, Fred, Jr., Estimator, R. O. Davis, Inc., Austin.
Stephan, K. R., Sales Engr., Airtemp Div., Chrysler Corp., Houston.

Washington (*Region* 4)

Brand, W. T.†, Office Mgr., Merrill N. Musgrave & Co., Spokane.

Wisconsin (*Region* 2)

Garber, E. W., Sales Mgr., Frank Garber Co., Inc., Wisconsin Rapids, Wis.
Hobbs, H. E., Htg. & Vtg. Designer, Stevenson Division of Hastings Air Control, Eau Clair.
McCormick, M. H., Field Test & Application Engr., General Controls Co., Milwaukee.

Canada (*Region* 7)

Baltuch, Siegmar, Sales Repr., Douglas Engineering Co., Ltd., Montreal, Que.
Brewer, K. J., Mech. Design Engr., Dept. of National Defence (AFHQ), Ottawa, Ont.
Evans, A. J., Pres. & Gen. Mgr., H. F. Clarke (BC) Ltd., Vancouver, B.C.
Gray, D. H., Chief Mech. Engr., E. A. Ryan, Montreal, Que.
Jones, Herbert, Area Supvsr., Consumers' Gas Co., Toronto, Ont.
Longman, D. C., Sales Engr., American-Standard Products (Canada) Ltd., Montreal, Que.
McBain, P. A., Sales Engr., Sheldons Engineering, Ltd., Toronto, Ont.
McBride, W. R., Mech. Engr., Archibald, Wannop & Co., Ltd., Vancouver, B. C.
McRae, G. K., Sales Engr., Sheldons Engineering, Ltd., Montreal, Que.
Poole, R. E., Design Draftsman, H. H. Angus & Assocs., Toronto, Ont.
Ross, E. J. G., Repr., Dunham-Bush Canada, Ltd., Toronto, Ont.
Shannon, P. W., Tech. Officer Grade 3, Northern Affairs & National Resources, National Parks Br., Ottawa, Ont.
Sherburn, P. E., Sales Engr., Sheldons Engineering, Ltd., Galt, Ont.

Sprague, R. E., Sales Engr., Honeywell Controls, Ltd., Winnipeg, Man.
Vance, G. D., Designer, Heat and Power Engineering, Ltd., Vancouver, B. C.
Young, E. H., Dist. Sales Mgr., Dunham-Bush Co., Ltd., Toronto, Ont.

England

Britton, J. C., Chief Supvsr., Perfectair, Ltd., London.
Koerner, W. B., Mech. Engr., Daniel, Mann, Johnson & Mendenhall, Ruislip, Middlesex.
Whatley, C. A., Asst. to Chief Tech. Repr., Perfectair, Ltd., London, S.W.

Iraq

Jani, T. Y., Asst. Resident Engr., Ministry of Dvlpt., Baghdad.

Union of South Africa

Megson, A. R. E., Chief A-C. & Refrig. Engr., Fox Theaters South Africa (PTY), Ltd., Johannesburg.

OBITUARIES

JAMES PETWAY EDMONDSON
San Diego, Calif.

The Society has been informed of the untimely death of James Petway Edmondson, 34, an engineer with Jackson & Blanc, San Diego, Calif. Mr. Edmondson joined the Society while an electrical engineering undergraduate at North Carolina State College, where he also studied heating and air conditioning.

Along with his college attendance, Mr. Edmondson worked as a supervisor for installation and maintenance of air-conditioning and refrigeration equipment for the U. S. War Department. He also served as a junior engineer with W. E. Bolton, Inc., Raleigh, N.C.

Recalled to active duty in 1950, he was in service in Korea. Upon his discharge, he became established with Jackson & Blanc in San Diego.

NORMAN J. FORRESTER
St. Laurent, Que.

Norman J. Forrester, 60, general manager, The Garth Co., St. Laurent, Que., Canada, died on March 27. Mr. Forrester, a member of the Montreal Chapter, held Society membership since 1936.

Following several years as apprentice and journeyman for James Ballantyne, he joined The Garth Co. in Montreal in 1920 as an estimator of plumbing, heating and ventilating systems. He later became manager of the contract division and subsequently, general manager.

Mr. Forrester made his home in Montreal. He is survived by his wife.

FRED W. NOLTE
Fairfield, Calif.

Fred W. Nolte, chief engineer, Air Installation, Travis Air Force Base, Fairfield, Calif., died recently at the age of 62. He was chief engineer and superintendent of utilities at the base since 1941.

In earlier years, Mr. Nolte acted as chief engineer for the Marine Ocean and Coast Ships, and as general superintendent of heating maintenance and repair in Seattle and Tacoma, Wash., for the *People's Saving & Loan Association*. He joined the Society in 1952 and was a member of the Sacramento Valley Chapter.

AMERICAN SOCIETY OF HEATING AND AIR-CONDITIONING ENGINEERS

(For most recent listing of Society Officers and committee personnel, see Frontispiece, Journal Section, p. 143)

Presidents and Secretaries of Society Chapters and Branches

The Society has chartered 67 Chapters, 1 Overseas Branch, and 6 Student Branches. These organizations elect their own officers and governing boards. Following is a list giving the name and address of the president and secretary of each of these groups.

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

ARIZONA

Arizona: 1953. Hdqrs., Phoenix. Meets, 1st Mon. PRES, E. P. Boothroyd, 1341 W. Catalina Dr. SECY, G. L. Jackson, Jr., 441 S. Robson, Mesa.

ARKANSAS

Arkansas: 1952. Hdqrs., Little Rock. Meets, 3rd Tues. PRES, H. H. Himstedt, 510 E. 3rd St. SECY, Allen Bullard, 509 E. Markham St.

CALIFORNIA

Golden Gate: 1937. Hdqrs., San Francisco. Meets, 1st Thurs. PRES, F. K. Crouch, 906 Cerrito St., Albany (6). SECY, J. B. Smith, 1129 Folsom St.

Sacramento Valley: 1952. Hdqrs., Sacramento. Meets, 1st Wed. PRES, V. W. Thornburg, 2470 27th Ave. SECY, S. W. Doolittle, 581 Swanston Dr.

Southern California: 1930. Hdqrs., Los Angeles. Meets, 1st Tues. PRES, H. F. Ulovec, 3886 Olympiad Dr. (43). SECY, A. Z. Levine, 239 S. Oxford Ave. (4).

COLORADO

Rocky Mountain: 1944. Hdqrs., Denver. Meets, 1st Wed. PRES, D. D. Pearsall, 120 W. 5th Ave. SECY, J. F. Perkis, 3453 S. Forest St. (22).

CONNECTICUT

Connecticut: 1940. Hdqrs., New Haven. Meets, 3rd Thurs. PRES, Fritz Honerkamp, 36 E. Maxwell Dr., West Hartford (7). SECY, F. J. Raible, Jr., 1007 Farmington Ave., West Hartford (7).

DISTRICT OF COLUMBIA

Washington, D.C.: 1935. Hdqrs., Washington, D.C. Meets, 2nd Wed. PRES, H. W. Rush, 116 Southwood Ave., Silver Spring, Md. SECY, L. D. Pain, 102-B Ames Rd., Silver Spring, Md.

GEORGIA

Atlanta: 1937. Hdqrs., Atlanta. Meets, 2nd Mon. PRES, J. A. Marshall, 1415 Howell Mill Rd. SECY, W. P. West, 409 Bishop St., N.W. (13).

ILLINOIS

Illinois: 1906. Hdqrs., Chicago. Meets, 2nd Mon. PRES, H. E. Anderson, 530-544 Hyde Park Ave., Hillside. SECY, J. C. Scott, 3819 N. Ashland Ave. (13).

Illinois-Iowa: 1956. Hdqrs., Moline. PRES, R. L. Graham, 301 Safety Bldg., Rock Island. SECY, D. H. Ninow, 1824 3rd Ave.

INDIANA

Indiana: 1943. Hdqrs., Indianapolis. Meets, 4th Tues. PRES, A. O. Roche, Jr., 3950 Broadway (5). SECY, W. F. Currise, 619 Architects & Builders Bldg. (4).

IOWA

Iowa: 1940. Hdqrs., Des Moines. Meets, 2nd Tues. PRES, W. A. Schworm, Physical Plant Dept., Iowa State College, Ames. SECY, C. B. Campbell, 3121 Dean Ave.

KANSAS

Kansas: 1951. Hdqrs., Wichita. Meets, Tues. after 1st Mon. PRES, H. M. Skalla, 2639 Sennett (16). SECY, J. C. Mikesell, 5426 E. Pine (6).

KENTUCKY

Bluegrass: 1954. Hdqrs., Louisville. Meets, 2nd Mon. PRES, W. J. Killian, 215 Central Ave. (8). SECY, A. E. Handmaker, 500 Bergman Ave. (8).

LOUISIANA

Baton Rouge: 1955. Hdqrs., Baton Rouge. Meets, 3rd Wed. PRES, A. W. Holland, 3958 Convention St. SECY, J. P. Jones, Box 358.

Delta: 1939. Hdqrs., New Orleans. Meets, 3rd Tues. PRES, L. R. Maxwell, 3038 Earhart Blvd. (25). SECY, J. H. Maloney, 318 Pan American Bldg. (12).

Shreveport: 1948. Hdqrs., Shreveport. Meets, 3rd Thurs. PRES, H. E. Scott, 1020 Market St., P.O. Box 1821. SECY, L. E. Kneipp, P.O. Box 1382.

Journal Section

MARYLAND

Baltimore: 1949. Hdqrs., Baltimore. Meets, 3rd Wed. PRES, R. E. Dressell, 3916 Ednor Rd. (18). SECY, J. H. Baker, 2 E. 22nd St. (18).

MASSACHUSETTS

Massachusetts: 1912. Hdqrs., Boston. Meets, 3rd Tues. PRES, E. L. Blair, 108 Willow Ave., Wollaston (70). SECY, R. E. Reid, 313 Washington St., Newton (58).

Western Massachusetts: 1955. Hdqrs., Springfield. PRES, J. E. Reed, 57 Main St., Westfield. SECY, C. R. Munn, 29 Logan St.

MICHIGAN

Michigan: 1916. Hdqrs., Detroit. Meets, 1st Mon. after 10th of month. PRES, P. S. Hosman, 16141 Harlow Ave. (35). SECY, J. B. Olivieri, 9317 Gratiot (13).

Western Michigan: 1931. Hdqrs., Grand Rapids. Meets, 2nd Mon. PRES, B. J. Walter, 333 Fuller Ave., N.E. (3). SECY, S. R. Curtis, 1810 W. Rundle, Lansing.

MINNESOTA

Minnesota: 1918. Hdqrs., Minneapolis. Meets 1st Mon. PRES, Fred Vogt, 6530 W. Lake St. (26). SECY, J. W. McNamara, 850 Cromwell Ave., St. Paul (14).

MISSISSIPPI

Mississippi: 1953. Hdqrs., Jackson. Meets, 4th Mon. PRES, T. D. Luke, P.O. Box 1134, 413 S. President. SECY, M. E. Arledge, P.O. Box 2324.

MISSOURI

Kansas City: 1917. Hdqrs., Kansas City. Meets, 1st Mon. PRES, S. C. McCann, 210 W. 10th St. (5). SECY, L. A. Heaven, 1529 Wyandotte (8).

St. Louis: 1918. Hdqrs., St. Louis. Meets, 2nd Tues. PRES, N. J. Hubbuch, 7020 Cornell, University City (5). SECY, K. O. Williams, 3200 Oliver Ave., East St. Louis.

NEBRASKA

Nebraska: 1940. Hdqrs., Omaha. Meets, 2nd Tues. PRES, L. J. Paulsen, 1901 S. 39th St. SECY, E. N. Seiler, 1824 N. 53rd St.

NEW JERSEY

North Jersey: 1952. Hdqrs., Newark. Meets, 2nd Tues. PRES, Martin Christesen, 21 Valley Brook Dr., Emerson. SECY, L. G. Huggins, 69 Woodland Ave., Glen Ridge.

NEW MEXICO

New Mexico: 1954. Hdqrs., Albuquerque. Meets, 3rd Tues. PRES, J. K. James, 4462 Avenida del Sol, N.E. SECY, G. F. Ard, 1822 Hermosa Dr., N.E.

NEW YORK

Central New York: 1944. Hdqrs., Syracuse. Meets, 4th Wed. PRES, Merle Weninger, 230 Goodrich Ave. SECY, S. F. Gilman, 300 S. Geddes St. (1).

Empire State Capital: 1951. Hdqrs., Albany. Meets, 2nd Wed. PRES, H. F. Kruger, 501 Seventh Ave., Troy. SECY, B. E. Mullen, Maplewood & Kraft Aves.

New York: 1911. Hdqrs., New York. Meets, 3rd Mon. PRES, C. R. Hiers, 19 Westminster Rd., Great Neck. SECY, L. D. Carr, 419 Fourth Ave. (16).

Western New York: 1919. Hdqrs., Buffalo. Meets 2nd Mon. PRES, G. E. Kuhn, 475 Woodland Dr., Kenmore (23). SECY, D. J. Seifert, 220 Delaware Ave. (2).

NORTH CAROLINA

Northern Piedmont: 1952. Hdqrs., Greensboro. Meets, 2nd or 3rd. Fri. PRES, C. A. Cofer, P. O. Box 6267, Summit Station. SECY, B. Jeglinski, 914 Summit Ave.

Southern Piedmont: 1952. Hdqrs., Charlotte. Meets, last Mon. PRES, G. C. Garrett, P. O. Box 3697 (3). SECY, N. W. McGuire, Jr., 1202 Commercial National Bank Building (2).

OHIO

Central Ohio: 1944. Hdqrs., Columbus. Meets, 3rd Mon. PRES, T. R. Walker, 182 N. Yale Ave. SECY, J. W. Ford, 931 S. Hague Ave.

Cincinnati: 1932. Hdqrs., Cincinnati. Meets, 1st Tues. PRES, R. G. Anderson, 1758 Elmore St. (23). SECY, C. P. Krantz, 2308 W. 8th St. (4).

Miami Valley: 1950. Hdqrs., Dayton. Meets, 1st Wed. PRES, L. P. Brehm, 315 S. Bromfield Rd. (9). SECY, N. O. Mitchell, 1441 Milburn.

Northern Ohio: 1916. Hdqrs., Cleveland. Meets, 2nd Mon. PRES, R. E. Leising, 3250 Dellwood Rd., Cleveland Heights (18). SECY, J. F. Koran, 4318 Bucyrus Ave. (9).

Toledo: 1954. Hdqrs., Toledo. Meets, 1st Mon. PRES, Robert Greenwald, 2525 Portsmouth Ave. (13). SECY, G. R. Munger, 1254 Shelly Ave., Maumee.

OKLAHOMA

Oklahoma: 1935. Hdqrs., Oklahoma City. Meets, 2nd Mon. PRES, A. C. Shelley, 2946 Nimitz (12). SECY, W. H. Stewart (Mail to: W. R. Johnson, 120 E. Main).

Northeastern Oklahoma: 1948. Hdqrs., Tulsa. Meets, 2nd Tues. PRES, C. H. Dollmeyer, 4972 E. 26th St. SECY, R. H. Combs, P. O. Box 871 (2).

OREGON

Oregon: 1939. Hdqrs., Portland. Meets, Thurs. after 1st Tues. PRES, W. B. Hayes, 6446 NE. 24 (11). SECY, W. S. Cooper, 445 Pittock Block.

PENNSYLVANIA

Philadelphia: 1916. Hdqrs., Philadelphia. Meets, 2nd Thurs. PRES, P. H. Yeomans, 10 S. 18th St. (3). SECY, D. S. Plewes, 2853 N. 12th St. (33).

Pittsburgh: 1919. Hdqrs., Pittsburgh. Meets, 3rd Mon. PRES, E. H. Riesmeyer, Jr., 231-33 Ft. Pitt Blvd. (22). SECY, G. E. Smetak, 1238 Brighton Rd. (33).

SOUTH CAROLINA

South Carolina: 1954. Hdqrs., Columbia. Meets, 3rd Mon. PRES, J. E. McMurray, 1639 Blanding St. SECY, A. L. Blackstone, Jr., 1630 Laurel St.

TENNESSEE

Memphis: 1944. Hdqrs., Memphis. Meets, 3rd Mon. PRES, R. H. Bolding, 107 East E. H. Crump Blvd. SECY, H. W. Wade, 1530 Madison.

TEXAS

Austin: 1956. Hdqrs., Austin. Meets, 3rd. Thurs. PRES, A. C. Lagow, 4506 Oakmont Blvd. SECY, Prof. J. R. Watt, M. E. Dept., University of Texas (12).

El Paso: 1956. Hdqrs., El Paso. Meets, 3rd Mon. PRES, G. H. Jackson, 1601 Bassett St., P.O. Box 512. SECY, M. W. Schlessinger, 4510 Nashville Ave.

Fort Worth: 1957. Hdqrs., Fort Worth. Meets, 3rd Wed. PRES, C. R. Gardner, P.O. Box 11173 (10). SECY, J. K. Mattox, Jr., 1705 Scenery Hill Rd.

North Texas: 1938. Hdqrs., Dallas. Meets, 3rd Mon. PRES, G. H. Meffert, 2025 Cedar Springs Ave. (1). SECY, J. D. Poythress, P.O. Box 35226 Airlawn Station.

South Texas: 1938. Hdqrs., Houston. Meets, 3rd Fri. PRES, J. C. Lewis, Box 8188. SECY, E. B. Appling, 4101 San Jacinto St. (4).

Southwest Texas: 1946. Hdqrs., San Antonio. Meets, 3rd Tues. PRES, Prof. C. L. Herndon San Antonio College, 1300 San Pedro Ave. (12). SECY, L. A. Ingle, Jr., 722 Hildebrand.

West Texas: 1953. Hdqrs., Lubbock. Meets, 1st Tues. PRES, H. L. Mayes, Box 151. SECY, W. R. Anthony, 902 E. 34th St.

UTAH

Utah: 1944. Hdqrs., Salt Lake City. Meets, 3rd Thurs. PRES, W. L. Stuewe, 1472 S. State St. (4). SECY, W. C. Leslie, 307 W. 2nd St.

VIRGINIA

Virginia: 1946. Hdqrs., Norfolk. Meets, 3rd Wed. PRES, D. C. Delinger, 424 W. 21 St. (10). SECY, J. A. Hoffman, 9522 Wells Pkwy.

WASHINGTON

Inland Empire: 1950. Hdqrs., Spokane. Meets, 1st Mon. PRES, J. A. Doyle, W. 3018 Broad. SECY, J. R. Morris, 5812 North C St.

Puget Sound (Formerly Pacific Northwest): 1928. Hdqrs., Seattle. Meets, 2nd Tues. PRES, E. W. Triol, 407 Medical Arts Bldg. SECY, R. H. Liniger, 1303 E. Lynn St. (2).

WISCONSIN

Wisconsin: 1922. Hdqrs., Milwaukee. Meets, 3rd Mon. PRES, H. W. Alyea, 507 E. Michigan St. (2). SECY, A. A. Stutheit, 2697 S. Kinnic Kinnic Ave. (7).

CANADA

British Columbia: 1952. Hdqrs., Vancouver. Meets, 2nd Wed. PRES, D. W. Thomson, 1690 W. Broadway (9). SECY, W. F. Keenan, 54 W. Fifth Ave. (10).

Chapitre de la Ville de Quebec: 1956. Hdqrs. Quebec, P.Q. PRES, Jean Veilleux, 350 E. Charest Blvd. SECY, R. A. Harnois, 604 St. John St., Rm. 203.

Manitoba: 1935. Hdqrs., Winnipeg. Meets, 4th Thurs. PRES, R. M. Fraser, 1855 Sargent Ave. SECY, J. J. MacKenzie, 45 Olivia St.

Montreal: 1936. Hdqrs., Montreal. Meets, 3rd Mon. PRES, D. J. McIntyre, Lafleur Bldg., Rm. 300, 3600 Barclay Ave. SECY, Paul Thibault, 4350 Sherbrooke St. W.

Northern Alberta: 1956. Hdqrs., Edmonton. Meets, 3rd Wed. PRES, P. M. Butler, 509 Northern Hardware Bldg. SECY, G. N. Campbell, 10124 104th St.

Ontario: 1922. Hdqrs., Toronto. Meets, 1st Mon. PRES, C. L. Torry, 117 Glengrove Ave. W. SECY, H. R. Roth, 57 Bloor St., W. (5)

Ottawa Valley: 1952. Hdqrs., Ottawa. Meets. 3rd Tues. PRES, D. W. Banton, 360 Richmond Rd. (3). SECY, Jacob Klassen, 454 Slater St. (4).

OVERSEAS BRANCH

Switzerland: 1952. Hdqrs., Zurich. PRES, Albert Eigenmann, Seestr. 125 (2). SECY, Hans Kamm, Spitalgasse 30, Bern.

STUDENT BRANCHES

North Carolina State College: 1948. Faculty Adviser: Prof. R. B. Knight, M. E. Dept., Raleigh, N. C.

Oregon State College: 1949. Faculty Adviser: Prof. G. E. Thornburgh, M. E. Dept., Corvallis, Ore.

Purdue University: 1948. Faculty Adviser: Prof. F. B. Morse, M. E. Dept., West Lafayette, Ind.

Texas A. & M College: 1946. Faculty Adviser: Prof. L. S. O'Bannon, M. E. Dept., College Station, Tex.

University of Detroit: 1949. Faculty Adviser: Prof. J. E. Lay, M. E. Dept., Detroit, Mich.

University of Toronto: 1951. Faculty Adviser: Prof. F. G. Ewens, M. E. Dept., Toronto, Ont., Canada.

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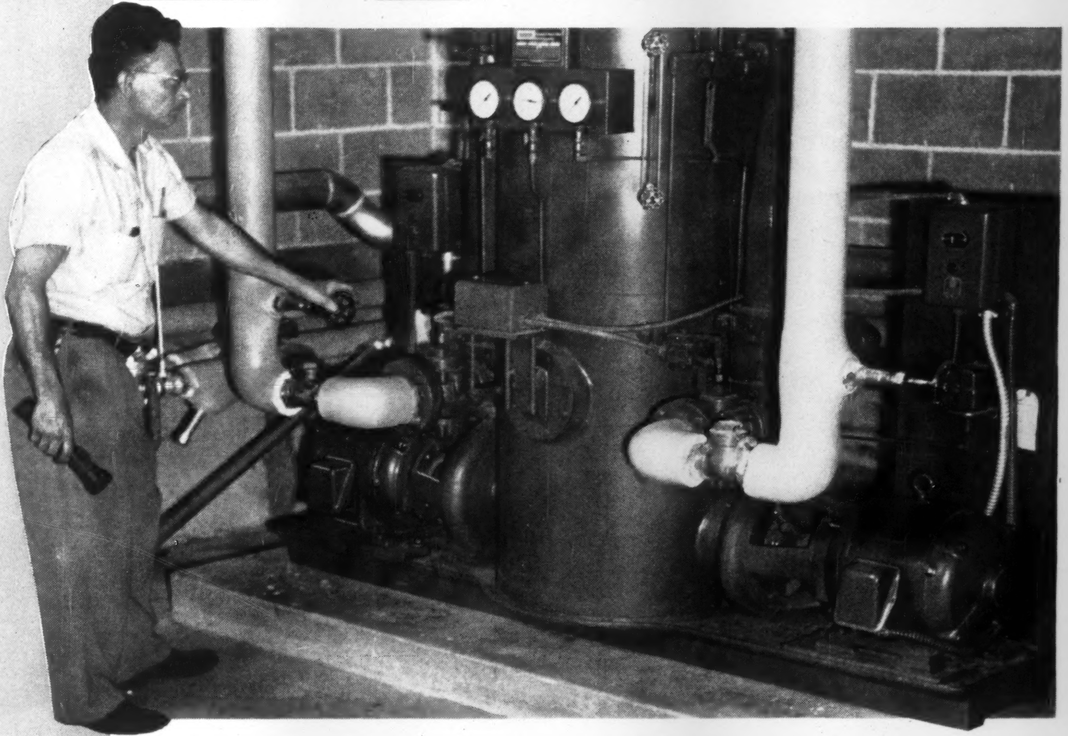

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When your equipment is driven by Century Motors, you can be sure of top performance! The reason? Century offers an unusually wide range of size, speed, frame and torque characteristics to choose from. Equipment manufacturers can provide you with *exact* application of motor to job.

For circulating pumps, compressors, cooling towers, fans, blowers, stokers . . . whatever the installation, you'll be ahead with precision performance and customer satisfaction when Century Motors are furnished. Specify Century for replacement motors, too . . . call or write your nearby Century District Sales Office or Authorized Distributor.

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1/20 to 400 H.P.

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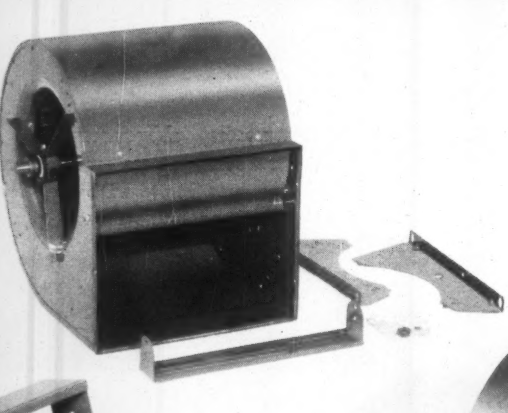
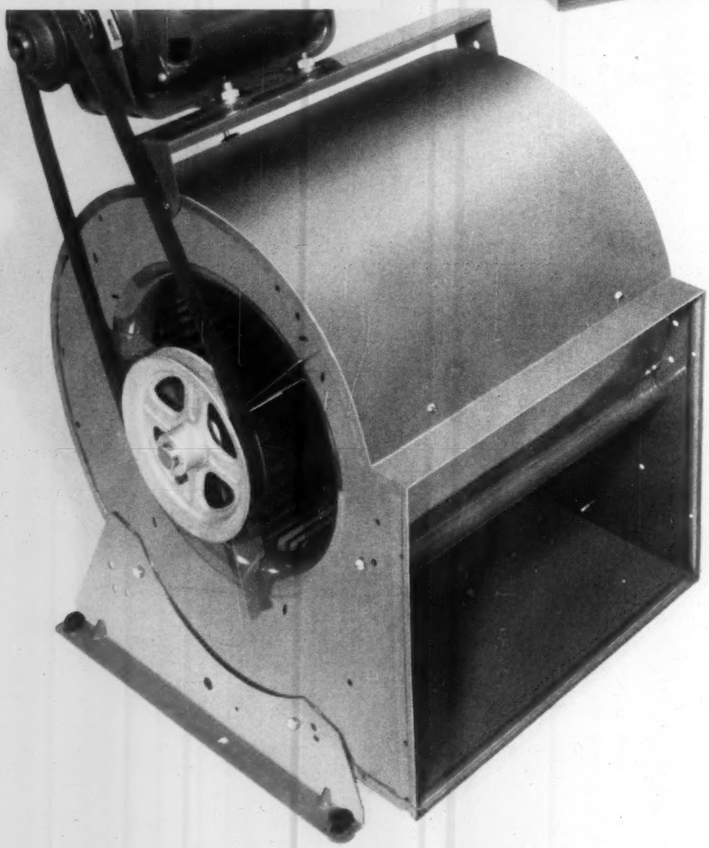
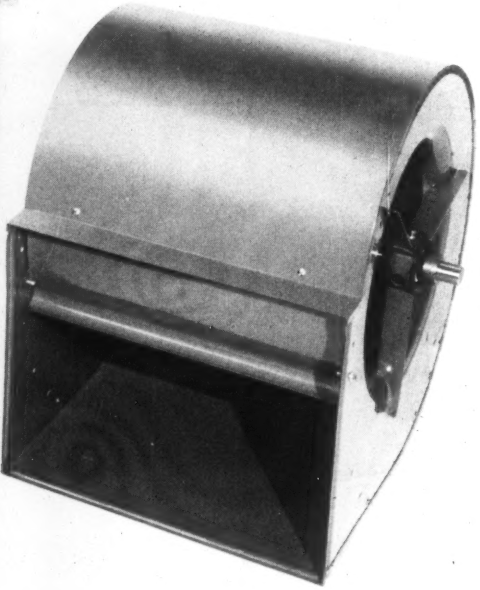
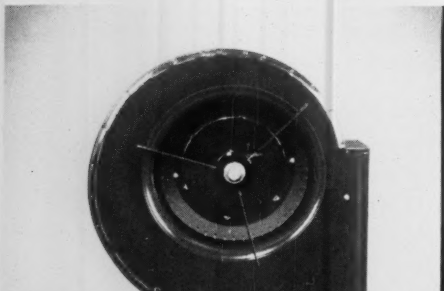


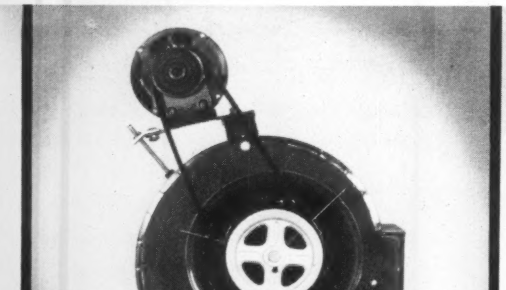






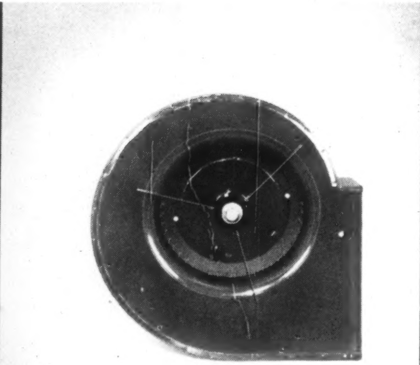
AP UNIVERSAL BLOWER

Gives you an assembled blower *fast* with any discharge. Meets 80% of blower requirements with minimum inventory.



AP ASSEMBLED BLOWER

For factory or field installation. Frees manufacturing space, saves tooling and time, guarantees peak performance.



AP BASIC BLOWER

Lowest cost answer to modern demand for compact units. Insures quiet air delivery and sales-building durability.

Completely New

AP

BRUNDAGE ALL PURPOSE BLOWERS

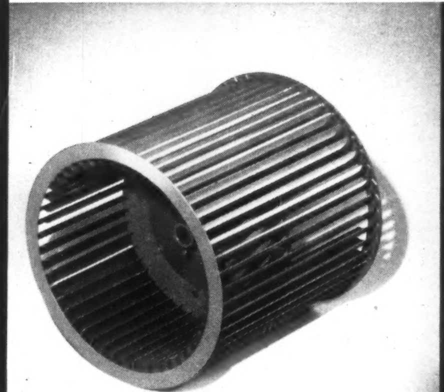
the first truly universal design

Gives you un-rivalled production flexibility—lowest blower cost

How a blower adapts to your designs, your production, and your field service standards — is the basic measure of its value to you. By those standards, this new series of blowers is unique.

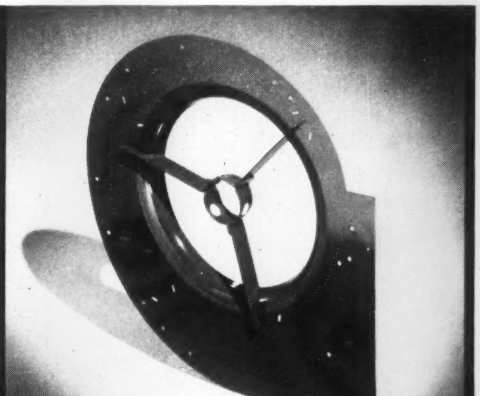
You know that true "universal" performance demands completely interchangeable parts. Brundage engineers now give it to you. They broke with the industry custom of minor modification to create a new family of blowers at one time. Manufacturing tools, machines, and techniques are new. Every part of each blower is a new product. The result is identical parts by the thousands with the precision tolerances and interchangeability of automated production. The new high-speed wheel, for example, is completely machine produced, blades assembled, locked into place, and jig-welded for perfect concentricity.

For the first time, full parts interchangeability is a practical fact. Whether you use the Basic Blower, the Universal Blower, an AP Series Assembly — or a combination of the three — your inventory and assembly procedures can be brought to peak efficiency. You know each blower and blower part is bound to fit, exactly.



NEW WHEEL

Die-formed parts, mechanically locked, then jig-welded for *perfect* concentricity — silent, high-speed service.



NEW SIDE PLATES

Includes 'Y' Bracket for smoother air flow. Slotted foot brackets insure perfect alignment, extra rigidity.

Samples of the Brundage AP Series Blowers are now available for manufacturers test. Measure their advantages in your own lab.

SEE WHY...

Your best buy's

BRUNDAGE

THE BRUNDAGE CO.
512 NORTH PARK STREET
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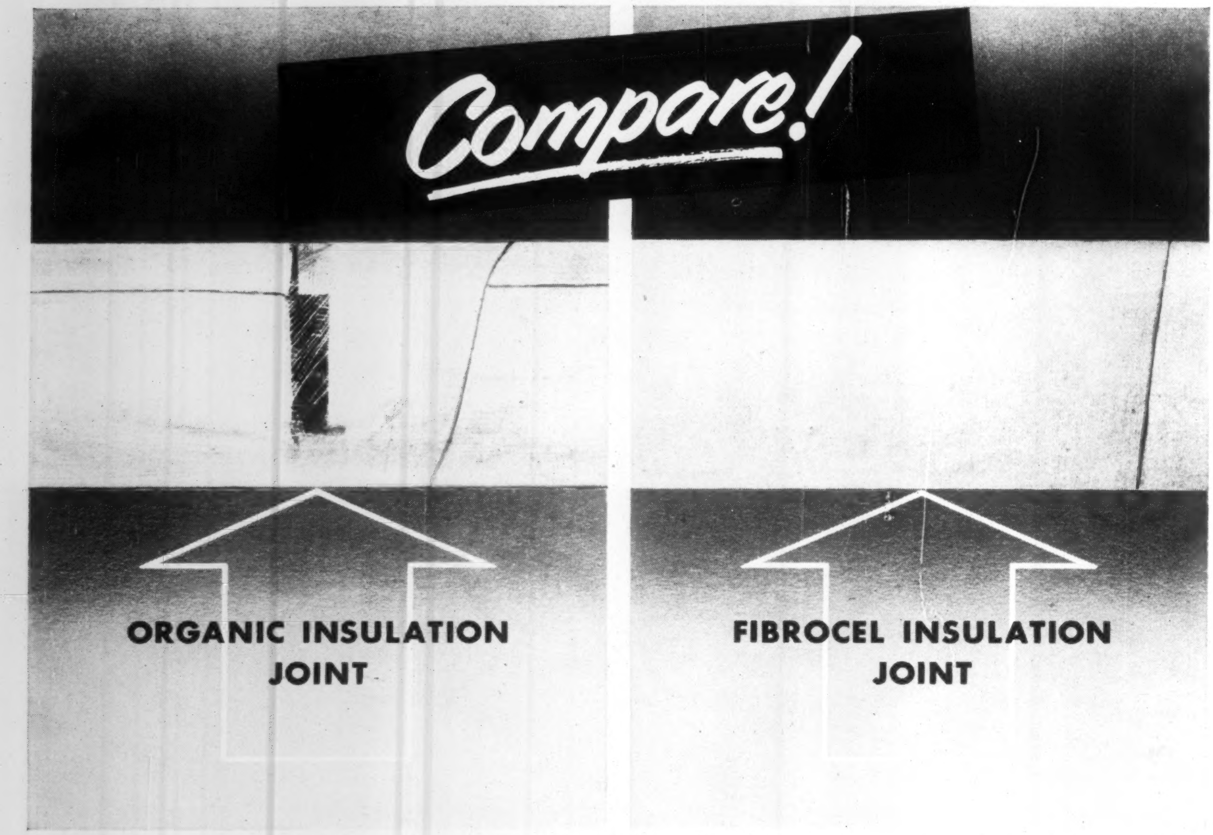

Joints are shown after exposure to high humidity and hot-pipe drying action under identical test conditions.

Shrinkage test proves joints *stay tight* with J-M FIBROCEL® Insulation

ONLY FIBROCEL OFFERS ALL THESE ADVANTAGES

No shrinkage—eliminates gaping joints. **Resists compression**—retains full-wall thickness. **Uniform dimensions**—precision formed for exact fit. **Economical application**—lightweight, easy to cut with a knife. **Thermally effective. Permanent**—flame, rot, odor and vermin proof. Developed by Johns-Manville Insulation Research.

A new molded silica insulation developed for plumbing, heating, chilled water and dual service applications in the 35F to 300F temperature range

Fibrocel completely eliminates objectionable shrinkage caused by atmospheric changes!

Tests prove it won't shrink even after moisture exposure and prolonged service under continuous steam flow. This means Fibrocel joints stay tight, with no unsightly gaps . . . messy patching . . . or costly heat loss—ever!

Fibrocel speeds installation, too! It is light in weight and a pleasure to apply. It cuts cleanly, easily with a knife. And its firmness and remarkable dimensional uniformity assure tight, smooth joints . . . and an overall finished appearance that's as neat, round, and true as the pipe itself.

For complete information on Fibrocel—get your free copy of the new 8-page folder, IN-155A. It includes physical properties, insulating characteristics, sizes and thicknesses available. Why not send for it today. Address Johns-Manville, Box 14, New York 16, New York. (In Canada, Port Credit, Ontario.)

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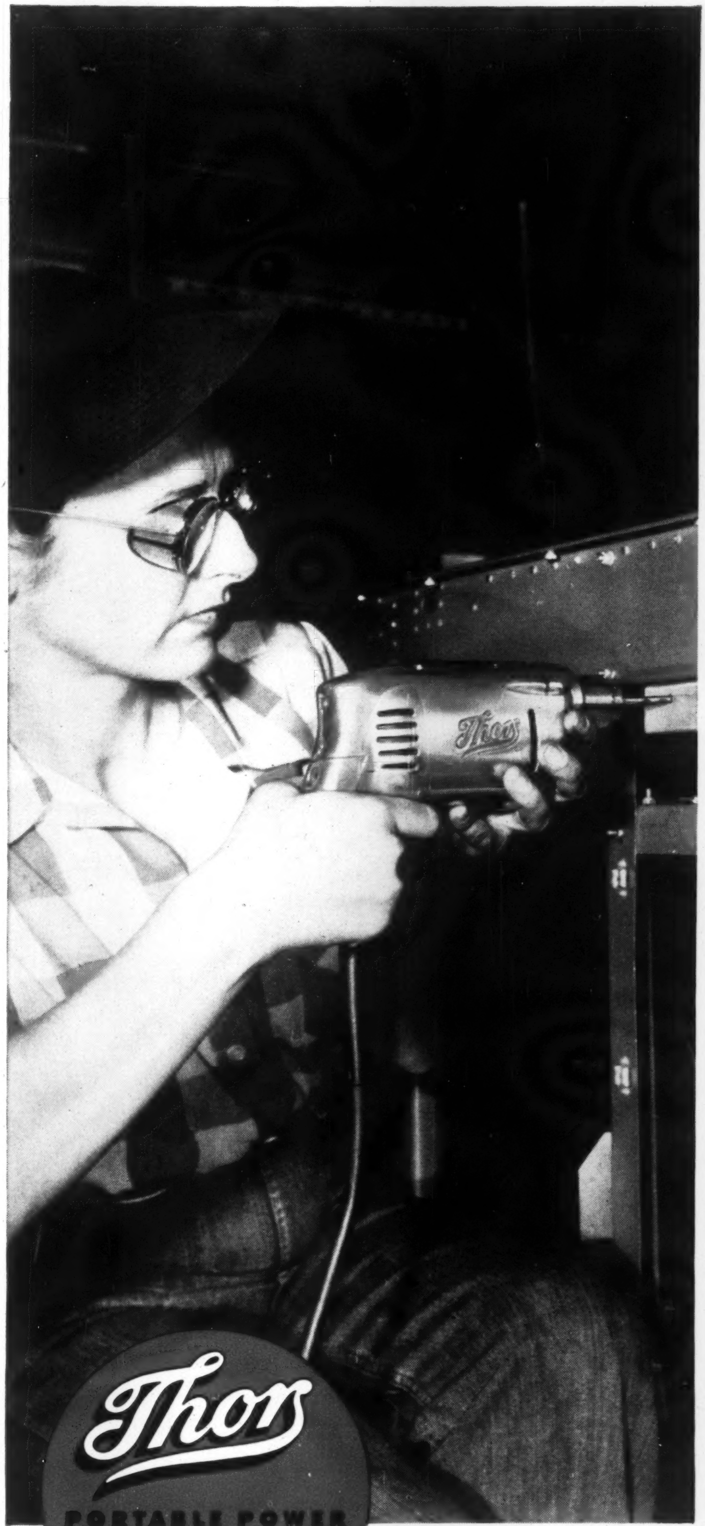
Johns-Manville *first in* INSULATION

MATERIALS · ENGINEERING · APPLICATION



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New Thor high speed drills proved in the aircraft industry and now available wherever high speed, high power drilling is necessary.

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THOR HIGH SPEED DRILLS

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New Thor U-14FH series of universal electric drills produces high power at high speed, cuts high production costs. Offered in 2900, 4500 and 5700 r.p.m. Thor U-14F series (500, 750 and 1500 r.p.m.) with the new high speed series rounds out a complete range of speeds and power. Ask your Thor distributor for a demonstration. Thor Power Tool Company, Prudential Plaza, Chicago 1, Illinois.

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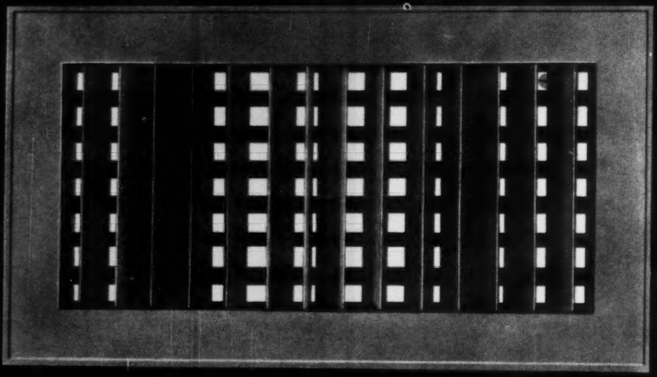
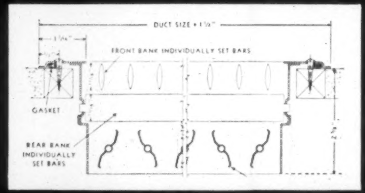
No. 190 SERIES MULTI-FLEX REGISTERS For Every Price Need

No. 190—for those better COMMERCIAL, INDUSTRIAL CONTRACTS

and All Applications where Air Handling must be Engineered at its best.

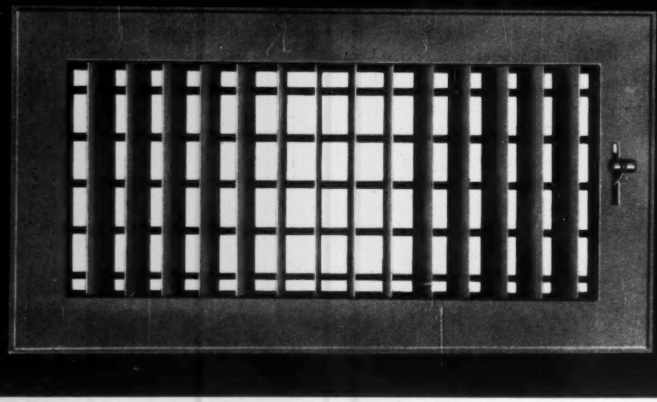


Distributes Diffused Air in any and all desired directions EVENLY and SILENTLY. Assures the Most Satisfactory Performance on every Heating-Cooling System. SCREW-DRIVER OPERATED OPPOSED valves (no loose keys to lose).

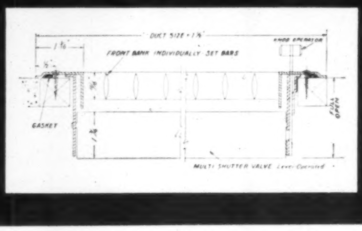

DUCT SIZE + 1½"
FRONT BANK INDIVIDUALLY SET BARS
GASKET
REAR BANK INDIVIDUALLY SET BARS

No. 192-L—a Lower Cost but very Efficient Multi-Flex Register

for Sidewall COMMERCIAL, RESIDENTIAL Air Conditioning Systems.



Parallel Lever-Operated rear valves make possible Up-Flow and Down-Flow change-overs from warm to cool air conditioning almost Instantaneous! Lateral Diffusion is obtained by individually set Double-Edged, Low-Resistance vertical grille bars.


DUCT SIZE + 1⅞"
KNOB OPERATOR
FRONT BANK INDIVIDUALLY SET BARS
GASKET
FULL OPEN
MULTI SHUTTER VALVE Lever Operated

Learn to know these VERY SUPERIOR LINES of U.S. 190 Series. You will create friends and increase profits wherever they're used.

Be sure to have your catalog file complete with our catalog No. 556 and latest prices.

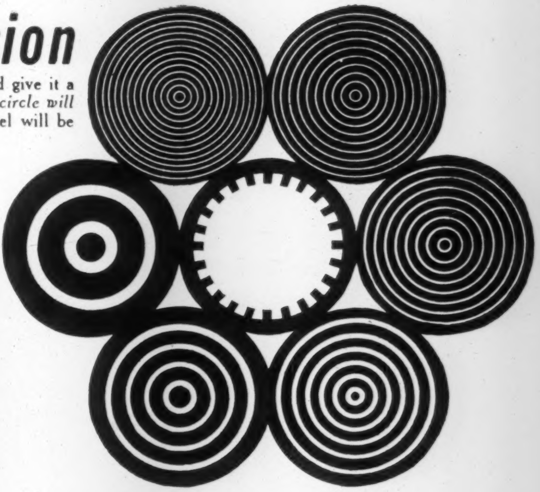
UNITED STATES REGISTER COMPANY

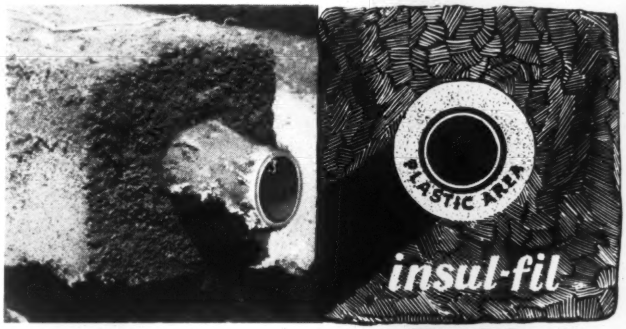
BATTLE CREEK, MICHIGAN

MINNEAPOLIS • KANSAS CITY • ALBANY

This is an illusion

HOLD this Diagram by the right hand bottom corner and give it a slight but *rapid* circular twisting motion, at which time *each circle will separately revolve on its own axis*. The inner cogged wheel will be seen to revolve in an opposite direction.





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insul-fil® the most highly efficient and economical "poured-type-insulation" available for underground steam and hot water distribution systems

The following comparative "K" factors were recorded at the Research and Development laboratories of the Atlantic Refining Company, and are evidence of INSUL-FIL's superiority.

The average "K" factor at 150 p.s.i.g. indicated the following values. These values were computed using 6" of material for the comparative evaluation. The average "K" factor on INSUL-FIL and 100% mined asphalt vary slightly depending on thickness of application.

"K" VALUES:

PERLITE	.39
INSUL-FIL	.451
100% MINED ASPHALT	.74
SOIL	3.12

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Installing contractor Rhode Island Covering Co., U. S. Naval Air Station, Quonset Point, R. I., Charles A. Maguire and Associates, Consulting Engineers, Boston, Mass., Providence, R. I.

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COLLEGES and INDUSTRY use *insul-fil*. Can you afford not to?

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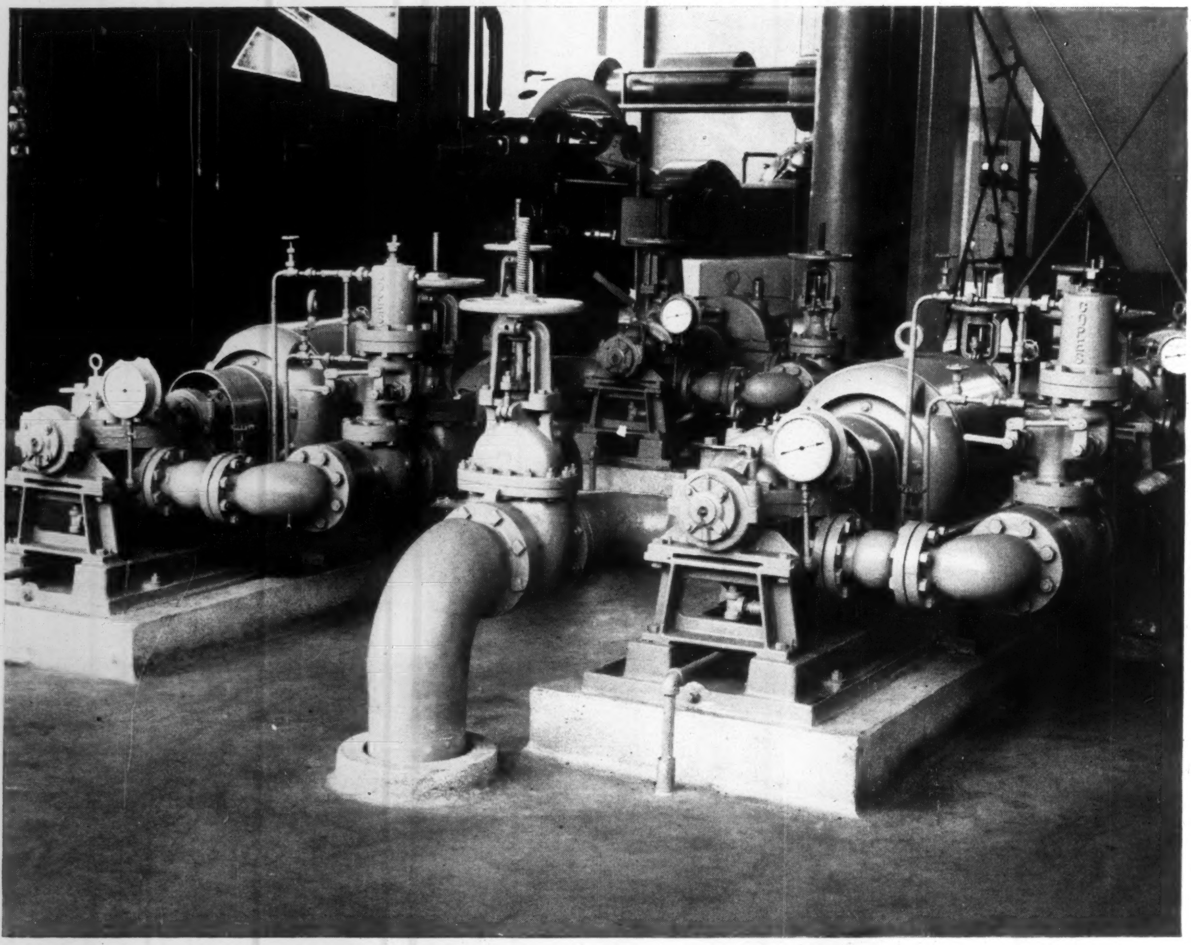
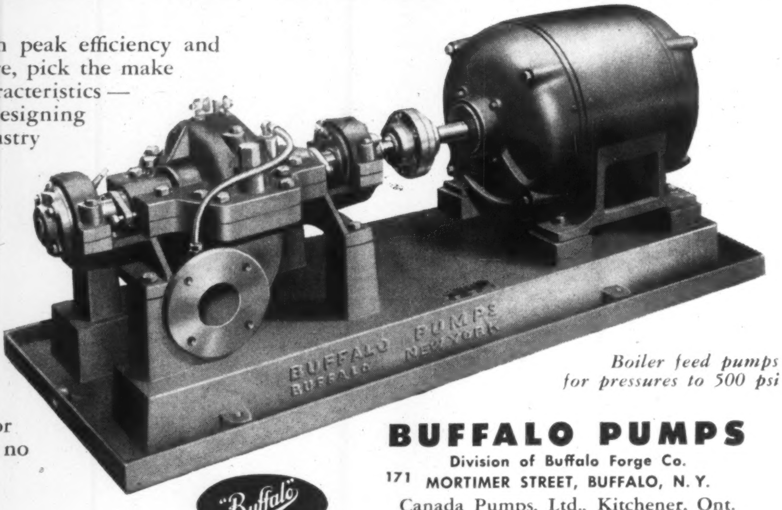


"Buffalo" Type RR Pumps on boiler feed at a large auto plant

"BUFFALO"—THE PUMPS THAT DON'T MIND BEING IN HOT WATER AND UNDER PRESSURE!

In selecting boiler feed pumps of both peak efficiency and year-after-year durability, under pressure, pick the make with the 80-year record for these characteristics—"Buffalo". This long experience in designing and building centrifugal pumps for industry has resulted in present-day "Buffalo" Pumps with every feature for maximum delivery at least power input—and for continuous service with negligible maintenance.

"Buffalo" Type RR two-stage and four-stage pumps have the typically efficient, balanced "Buffalo" impellers—the oversize bearings and shafts—the rugged casings with simply formed water passages and deep 8-ring stuffing boxes. Write for Bulletin 980 and see why we say there's no better buy!



Boiler feed pumps for pressures to 500 psi

BUFFALO PUMPS
Division of Buffalo Forge Co.
171 MORTIMER STREET, BUFFALO, N. Y.
Canada Pumps, Ltd., Kitchener, Ont.
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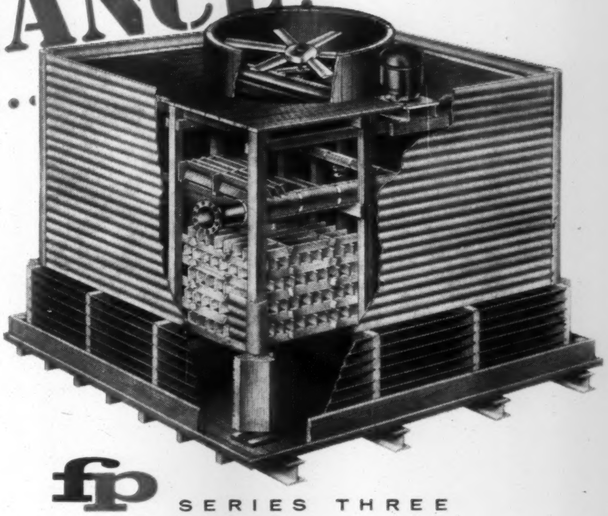
"Buffalo"

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

FLUOR CERTIFIED PERFORMANCE



FOR YOUR PROTECTION all performance rating data used to design Fluor Series 3 Counterflow Cooling Towers bears the stamp "Certified Performance."

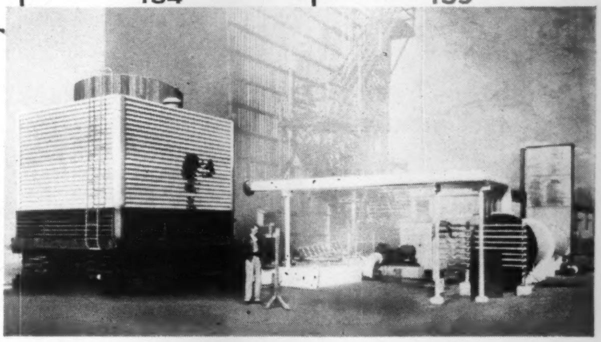
To you who specify cooling towers for air conditioning and refrigeration service this means:

1. **That the cooling tower offered has undergone rigorous tests for efficiency through complete ranges of actual heat transfer conditions.**
2. **That the rating data developed is realistic — established under tests duplicating those of virtually every operating condition.**
3. **That the data thus developed — and used by Fluor — has been authenticated when compared with test data furnished by an impartial, independent research organization.***

The following tables compare the performance rating data used by Fluor in designing your tower, with the test findings of an independent organization.

fp SERIES THREE

DESIGN CONDITIONS			FLUOR RATED PERFORMANCE	INDEPENDENT TEST DATA*
WET BULB TEMP.	WATER OFF TEMP.	WATER ON TEMP.	TONS REFRIGERATION	TONS REFRIGERATION
70	80	90	174	184
70	77.5	85	121	128
75	85	95	196	214
78	85	95	160	163
78	86	96	178	185
78	85	92.5	140	155
78	87.5	95	181	218
78	86	93.5	159	163
80	86	93.5	134	139



* INDEPENDENT PERFORMANCE TEST RESULTS obtained for Fluor Products Company by Texas Engineering Experiment Station on December 6 and 7, 1956 at Fluor's Cooling Tower Research and Test Center in Los Angeles, California.

The Texas Engineering Experiment Station is a part of Texas A & M College System. The station provides research facilities for the college and conducts independent tests for governmental agencies and industrial organizations.

Texas Engineering Experiment Station provides test data only and does not endorse this or any product.

Illustration at right shows a Fluor Series 3 Cooling Tower being performance tested under actual heat transfer conditions.

AIR CONDITIONING & REFRIGERATION COOLING TOWER DIVISION

FLUOR PRODUCTS COMPANY

A DIVISION OF THE FLUOR CORPORATION, LTD.

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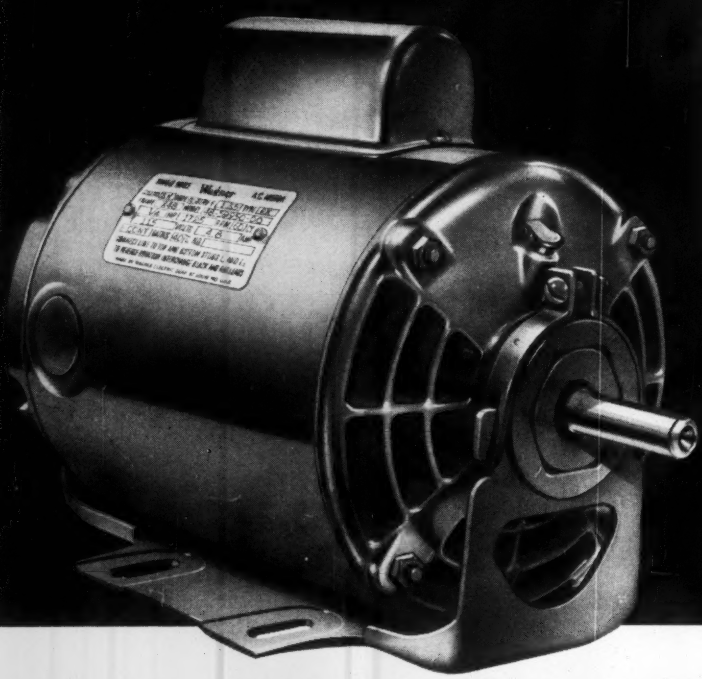
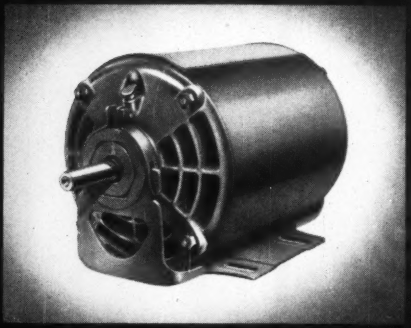
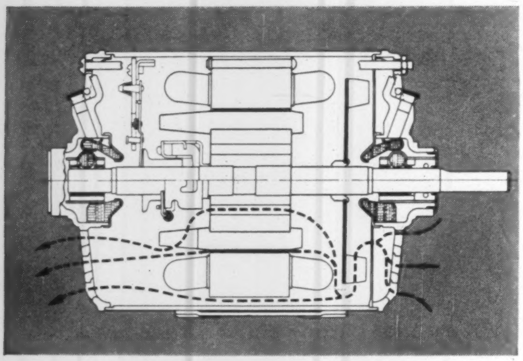
DESIGN ENGINEERS!





This compact, cool-running fhp motor saves space and weight... mounts at any angle

the WAGNER "48"



OUTSTANDINGLY EFFICIENT COOLING SYSTEM

Schematic drawing shows how a large volume of air is directed through the motor to effectively reduce temperatures. Large blower at right draws air in through drip-proof openings in back endplate, forces it around back coil extension—through rotor vent holes—air gap—and through passages between stator core and frame. Cast blower at left circulates air around coil extension and drives it out the motor through front endplate openings.

Savings in space and weight are among the many advantages of using Wagner "48" capacitor-start or split-phase motors in your equipment. These motors come in the standard 48 frame sizes and weigh from 3 to 8 pounds less than the previous models in the same hp ratings.

Because no parts of the motor mechanism are housed in the endplates, it is possible to materially reduce their depth. An effective lubrication system assures positive protective lubrication for the bearings in any position. You can mount these motors at the angle best suited to your equipment.

The capacitor-start, Type RK "48" comes in ⅙ or ¼ hp ratings, and the split-phase, Type RB "48" in ⅙, ¼ or ⅓ hp. Both types are available with resilient bases or with rigid bases that are welded to the steel motor frames for ruggedness and strength. You can get these motors from leading motor distributors in your community and from Wagner sales offices in 32 principal cities. Check your telephone directory for the supplier nearest you. Write for your file copy of NEW Bulletin MU-217 on the Wagner "48".

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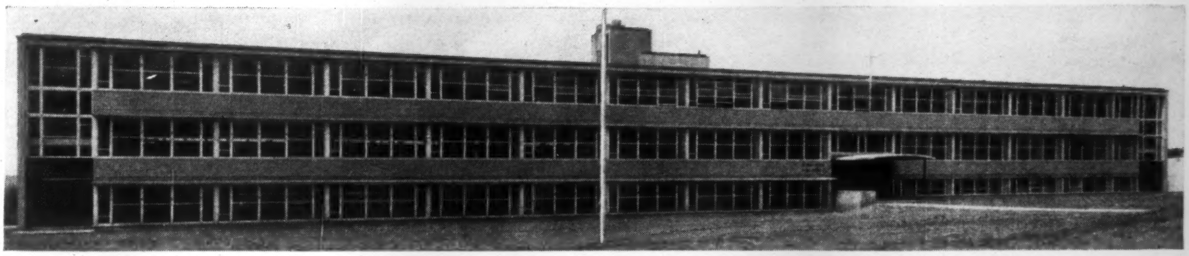
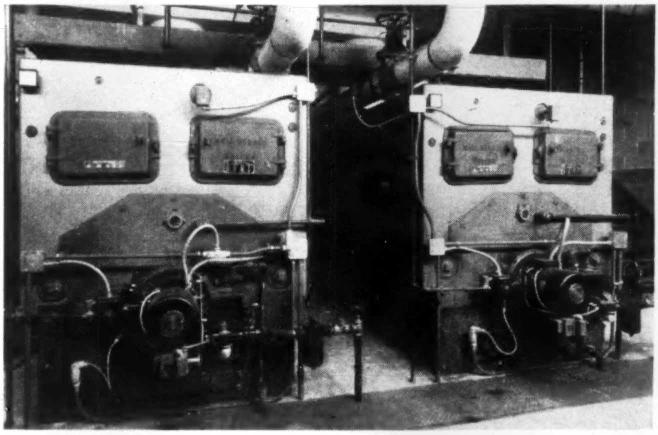


The boiler that best meets every *School Requirement*



Installation of Weil-McLain "HR" Boilers equipped with rotary oil burners in St. Mathews High School, Philadelphia, Pa.

Why the WEIL-McLAIN "HR" BOILER MOST EFFICIENTLY BURNS HEAVY OILS

The "HR" Boiler was designed in cooperation with leading manufacturers of horizontal rotary oil burners. The features below show why it provides the most favorable burning conditions and efficiently absorbs the intense heat of rotary burner flames.

❶ Large firebox volume develops better combustion conditions and maximum radiant heat transmission.

❷ Curved primary heating surface extends from crown sheet, greatly increasing area directly above the fire.

❸ Balanced gas travel through the flueways assures equal distribution of heat to all secondary heating surfaces.

❹ Generous waterways permit rapid, efficient water circulation through boiler.

❺ Large steam space assures rapid generation of dry steam.

❻ Rugged cast iron construction for durability and trouble-free operation.

❼ Individual short draw rods simplify assembly and contribute to longer boiler life.

❽ Special steel front plate and section simplify installation of rotary burner.

❾ High base makes more combustion space available—eliminates high brick foundation.

Here's why the Weil-McLain "HR" Series Cast Iron Boiler for horizontal rotary oil burners is the ideal selection for schools...*or any other large installation!*

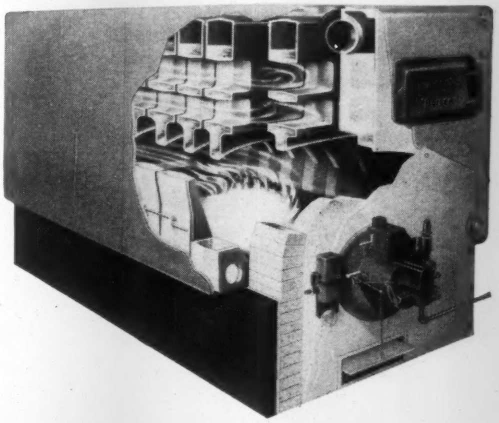
Low operating cost. Designed specifically to fully develop the heating economy obtainable with low-cost heavy oils.

Saves in construction cost. The "HR" can be installed in a smaller boiler room—no space needed for pulling boiler tubes—less head room required.

Permits future building expansion. Extra capacity can be provided by adding sections. "HR" sections pass through an ordinary door.

Inexpensive maintenance. Easily cleaned for top efficiency. Repairs in general are minor because cast iron boilers are immune to usual causes of breakdown.

Longer lived. Cast iron is more resistant to corrosive effects of flue gas. The tough outer skin of "HR" Boiler sections is left on to protect against rusting—no face grinding.



WEIL-McLAIN

WEIL-McLAIN
BOILERS · RADIATORS

"HR" SERIES BOILERS
FOR HORIZONTAL ROTARY OIL BURNERS

WEIL-McLAIN COMPANY · Dept. AA-77 · Michigan City, Indiana

Contracts are more profitable when you install dependable

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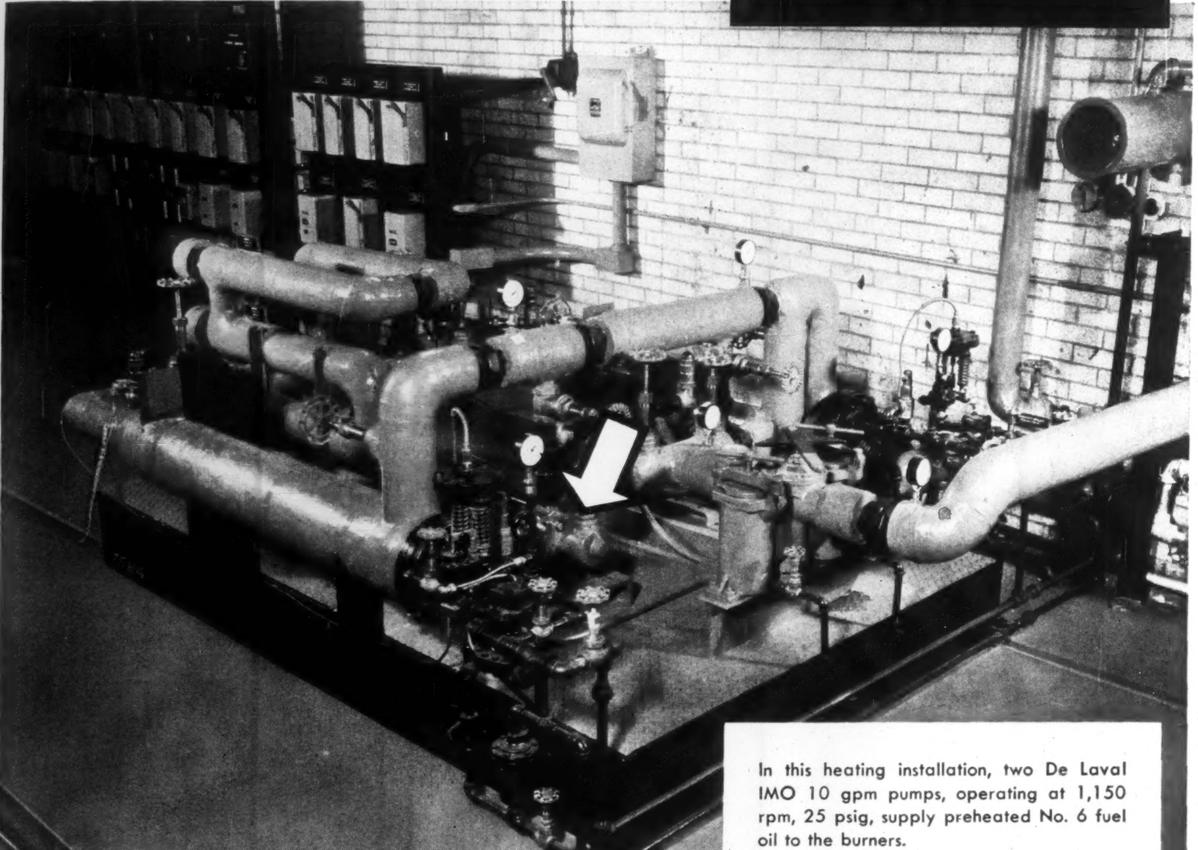
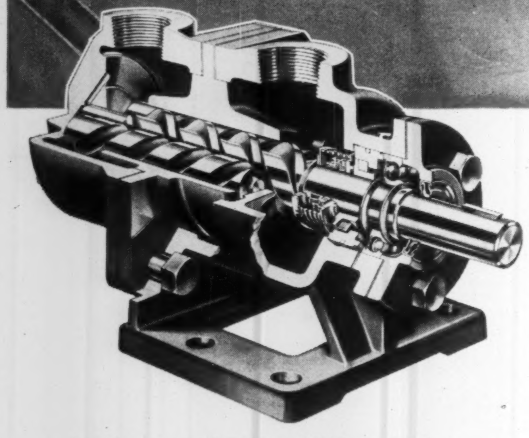
IMO PUMPS



In this heating installation, two De Laval IMO 10 gpm pumps, operating at 1,150 rpm, 25 psig, supply preheated No. 6 fuel oil to the burners.



A wide range of De Laval IMO models specifically built for fuel oil service is available. Capacities up to 80 gpm, pressures to 275 psig. Write today for Bulletin LG-A.

To increase your present—and future—profits on commercial heating jobs, install *dependable* De Laval IMO pumps on pump and heater sets. Their simple, trouble-free design saves you money on service calls . . . builds customer goodwill, for there's nothing to get out of order or need adjustment. No pilot gears, no sliding vanes, no reciprocating pistons. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation.

DE LAVAL *IMO Pumps*

DE LAVAL STEAM TURBINE COMPANY

871 *Nottingham Way, Trenton 2, New Jersey*

DL272

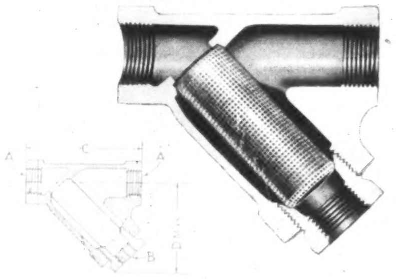
HOFFMAN

"Y" STRAINERS
125-250 PSI

INSTALL HOFFMAN STRAINERS AHEAD OF ALL VALVES, PUMPS AND TRAPS ESPECIALLY ON NEW INSTALLATIONS

SERIES No. 400A

125 PSI—SEMI-STEEL



NO. 400-A "Y" STRAINER

Hoffman No. 400-A "Y" type, self cleaning dirt strainers are furnished with a .025 brass screen with .045 perforations. Precision machined, semi-steel body. For use on steam, water, oil, air, or gas service. Made in ½″ through 2″ pipe sizes. Maximum pressure 125 lbs. Can also be furnished with monel or stainless steel screens.

ROUGH-IN DIMENSIONS			
Size A	Cleanout B	Length C	D
½″	⅜″	3¹⁵⁄₃₂″	3″
¾″	½″	4⅛″	3⁷⁄₁₆″
1″	¾″	4¾″	4¹⁄₁₆″
1¼″	1″	5⁷⁄₁₆″	4½″
1½″	1¼″	6³⁄₁₆″	5⁵⁄₁₆″
2″	1½″	7⁷⁄₁₆″	6⅛″

125# SEMI-STEEL BODY—.025 BRASS SCREEN WITH .045 PERFORATIONS

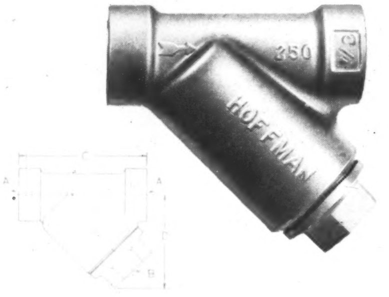
SIZE	SCREEN RATIO* .045 Perf.	WEIGHT LBS.
½″	5 to 1	1½
¾″	4.46 to 1	2½
1″	4.1 to 1	3¾
1¼″	3.26 to 1	5¼
1½″	3.13 to 1	7½
2″	3.3 to 1	11

Monel and stainless steel screens with .033 or .045 perforations and brass screens with .033 perforations available at additional cost.

*Ratio of total effective screen area to the inside pipe area.

SERIES No. 411A

250 PSI—SEMI-STEEL



NO. 411-A "Y" STRAINER

Hoffman No. 411-A "Y" strainers can be used for steam, water, oil, air, or gas service. Made of semi-steel, these strainers are precision machined for correct alignment and easy removal of the strainer screen. Available in sizes ½″ through 3″, with a .025 monel screen with .045 perforations. Brass and stainless steel screens available. Max. press.: 250 P.S.I.

ROUGH-IN DIMENSIONS			
Size A	Cleanout B	C	D
½″	½″	3⁹⁄₁₆″	2⅝″
¾″	½″	4¼″	3½″
1″	½″	5″	3⅝″
1¼″	½″	5³⁄₁₆″	4½″
1½″	¾″	6⅜″	4⅝″
2″	¾″	7⅞″	6″
2½″	1¼″	9″	6½″
3″	1¼″	10¾″	8″

250# SEMI-STEEL BODY—.025 MONEL SCREEN WITH .045 PERFORATIONS

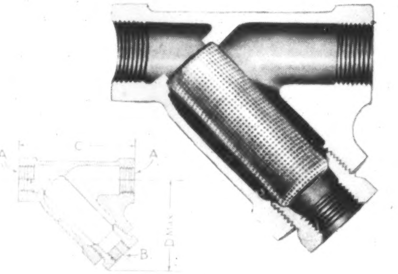
SIZE	SCREEN RATIO* .045 Perf.	WEIGHT LBS.
½″	6.3 to 1	1¾
¾″	6 to 1	2½
1″	5.5 to 1	4½
1¼″	5.2 to 1	6½
1½″	5 to 1	8½
2″	4.8 to 1	13½
2½″	4.2 to 1	19
3″	3.7 to 1	30

Brass and stainless steel screens with .033 or .045 perforations, and monel screens with .033 perforations, available at additional cost.

*Ratio of total effective screen area to the inside pipe area.

SERIES No. 421A

250 PSI—BRASS



NO. 421-A "Y" STRAINER

Hoffman No. 421-A—cast brass, precision machined, "Y" strainers are designed for use on steam, air, gas, water, and oil service. Available in sizes ½″ through 3″, with a .025 monel screen with .045 perforations. Stainless steel and brass screens available. Maximum pressure: 250 P.S.I.

ROUGH-IN DIMENSIONS			
Size A	Cleanout B	C	D
½″	⅜″	3¹⁵⁄₃₂″	3″
¾″	½″	4⅛″	3⁷⁄₁₆″
1″	¾″	4¾″	4¹⁄₁₆″
1¼″	1″	5⁷⁄₁₆″	4½″
1½″	1¼″	6³⁄₁₆″	5⁵⁄₁₆″
2″	1½″	7⁷⁄₁₆″	6⅛″
2½″	1¼″	9″	6½″
3″	1¼″	10¾″	8″

250# BRASS BODY—.025 MONEL SCREEN WITH .045 PERFORATIONS

SIZE	SCREEN RATIO* .045 Perf.	WEIGHT LBS.
½″	5 to 1	1¾
¾″	4.5 to 1	2½
1″	4.1 to 1	4
1¼″	3.3 to 1	5¾
1½″	3.3 to 1	7¾
2″	3.3 to 1	12½
2½″	4.2 to 1	22½
3″	3.7 to 1	35½

Brass and stainless steel screens with .033 or .045 perforations, and monel screens with .033 perforations, available at additional cost.

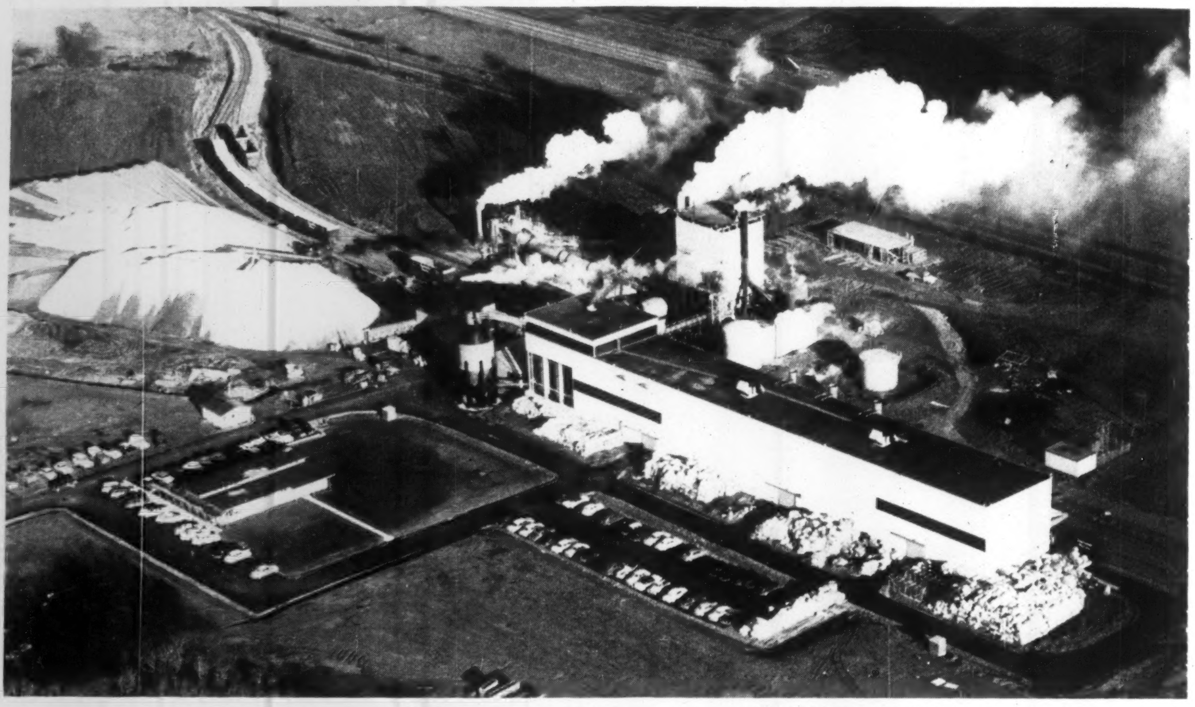
*Ratio of total effective screen area to the inside pipe area.

Cast Brass "Y" Strainers available for 400 PSI max. oper. pressure.

HOFFMAN SPECIALTY MFG. CORP. • 1700 West 10th Street, Indianapolis 7, Indiana

Makers of Valves, Traps, Hot Water Heating Systems, Vacuum and Condensation Pumps . . . Sold by Leading Wholesalers of Heating and Plumbing Equipment

At this new Western Kraft plant...



Consulting Engineers and Architects: SANDWELL & COMPANY,
Vancouver, B. C.

General Contractor: HOFFMAN CONSTRUCTION CO.,
Portland, Ore.

Mechanical Contractor: HOFFMAN ENGINEERING CO.,
Portland, Ore.

Plumbing Contractor: VERN COLLINS PLUMBING CO., Salem, Ore.

— as in the selection of a plant site,
efficiency determined the choice of

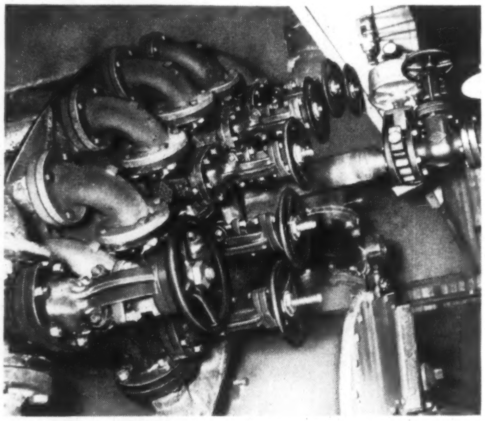
JENKINS VALVES

It hits you even before your tour through the new Western Kraft Corporation plant begins. *Efficiency*. From forest to finished product, here is efficient operation in the manufacture of high-quality kraft paper.

The plant site — a 100-acre tract near Albany, Oregon — was selected primarily because of its central location in relation to the supply of wood chips from the surrounding timber areas.

All operating equipment was chosen with the same foresight, on the basis of proved ability to do its job to perfection. When it came to valves for controlling processing and other piping, an experienced management, architects, engineers and contractors quickly wrote the specification . . . "JENKINS".

No other valves have such a long record of efficient, economical performance. The Jenkins Diamond on a valve has been a mark of extra value, trusted by building experts and plant operating men for nearly a century. Valves that bear this famous mark cost no more. Jenkins Bros., 100 Park Ave., New York 17.



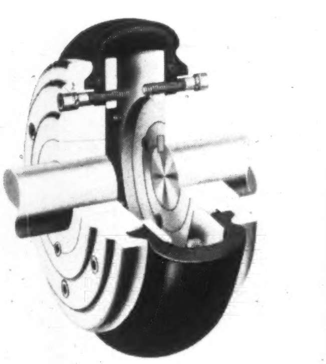
Manifold of Jenkins Nickel Iron Gate Valves on the liquor washers controlling the showers.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
TRADE JENKINS MARK
SINCE 1864
Jenkins Bros

Sold Through Leading Distributors Everywhere

EQUIPMENT DEVELOPMENTS . . .

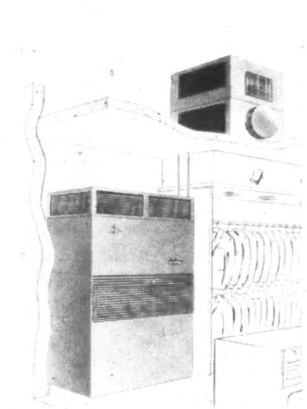
For reviews of Recent Trade Literature see Page 254



Flexible Coupling . . .

. . . with rubber tire feature—*Dodge Mfg. Corp., Dept. HPAC, Mishawaka, Ind.*

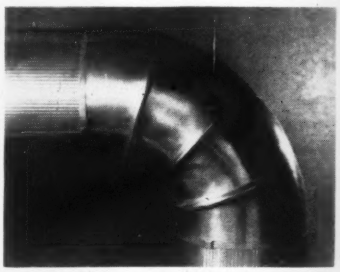
Designed to handle angular misalignment, parallel misalignment and end-float, and in any combination. Also cushions shock loads, diminishes torsional vibration, thus protecting driver and driven machine, says company. Heart of "Para-flex" unit is tire with synthetic tension members bonded together in rubber. In capacities from 4 hp at 1800 rpm to 600 hp at 900 rpm.



Air Conditioners . . .

. . . in air cooled commercial packaged series—*Airtemp Div., Chrysler Corp., Dept. HPAC,* 1600 *Webster St., Dayton* 1.

In sizes to 30 tons capacity. Development is result of two new remote air cooled condensers which (two or more as required) operate in conjunction with company's standard 10 to 30 ton packaged units. Condensers feature new control system that permits them to operate between zero and 120 F outside air temperature, says company. Shown is 10 ton system employing packaged conditioner and roof located air cooled condensers.



Aluminum Jackets . . .

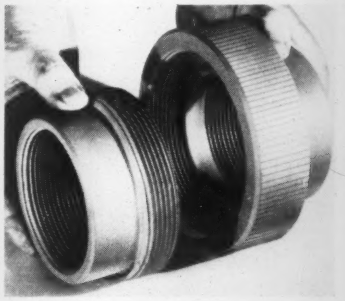
. . . for protecting insulated elbows—*Childers Mfg. Co., Dept. HPAC, P. O. Box* 7467, *Houston* 8.

"Ell-Jackets" are deep drawn from 0.02 in. aluminum. Available for 90 and 45 deg ells. With factory applied moisture barrier. Jackets are two-piece, precision formed to fit snugly over insulated elbow. Applied using aluminum sheet metal screws.

Dehumidifier . . .

. . . designed to require no cycling valves, cycling towers, timers—*Bryant Mfg. Co., Dept. HPAC,* 2020 *Montcalm, Indianapolis.*

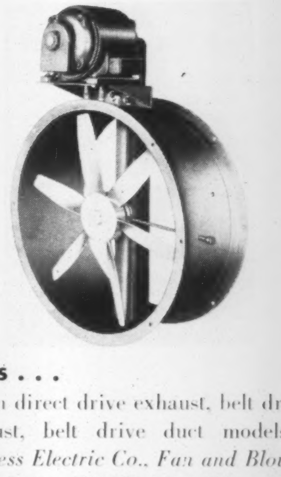
"Model AO9A" delivers 150 cfm of air. Can be installed multiply in large spaces. Electric current required is 230 volt, three wire power supply. Recommended by company for small industrial, commercial applications.



PVC Pipe Union . . .

. . . available in new 3 in. size—*Walworth Co., Dept. HPAC,* 60 *E.* 42*nd St., New York.*

Larger union, made of rigid polyvinyl chloride, increases pvc piping application possibilities, says company. Surfaces in joints of three-part union are said to provide tight seal against flow leakage. Recommended by manufacturer for handling corrosive fluids in food and chemical processing industries, refining industry, other fields. Available with threaded or solvent-weld socket-type ends in high or normal impact pvc.

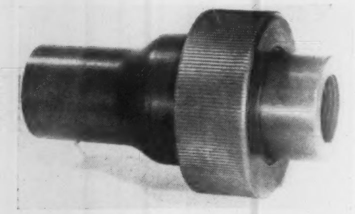


Fans . . .

. . . in direct drive exhaust, belt drive exhaust, belt drive duct models—*Peerless Electric Co., Fan and Blower Div., Dept. HPAC,* 1401 *West Market St., Warren, Ohio.*

Direct drive exhaust units usually

applied to exhausting air or ventilating restaurant kitchens, taverns, laundries, dry cleaning plants, similar establishments. Belt drive exhaust fans recommended by company for where it is necessary to move air at lowest possible noise level. Belt drive duct models are said to be well suited for paint spray booths, industrial ventilation, air exhaust. All three models available in variety of sizes, types.



PVC Lift Check Valve . . .

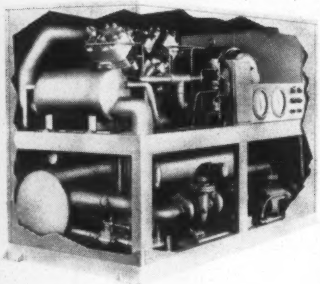
. . .constructed to be simple, durable, efficient—*Tube Turns Plastics, Inc., Dept. HPAC, 2929 Magazine St., Louisville* 11.

Will operate in vertical or horizontal position, open and close under less than 6 lb pressure, says company. Only moving part is self energizing disc. Valve available in ½, ¾, 1, 1¼, 1½, 2, 3 in. sizes, in threaded or socket welding type. Material is normal impact polyvinyl chloride.

Filters . . .

. . .engineered for high air cleaning efficiency in sub-micron ranges—*Farr Co., Dept. HPAC, 2301 Rosecrans Ave., El Segundo, Calif.*

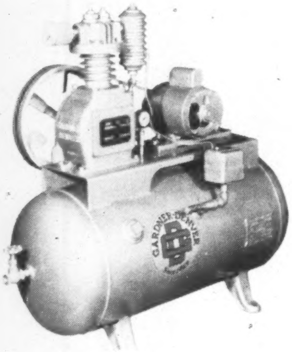
Are said to be effective in removing dust particles as small as 0.1 micron in diameter. Filters available in range of sizes with individual capacities 30 to 5000 cfm. Construction consists of deep, closely-spaced folds of filter paper fitted into rectangular frame. Three basic types available are "Type I" for use in temperatures below 225 F and noncorrosive conditions, "Types II" and "III" for use in temperatures to 1000 F or in corrosive atmospheres.



Packaged Coolers . . .

. . . in new 60, 75 ton models—*Bell & Gossett Co., Dept. HPAC, Morton Grove, Ill.*

Only outside wiring, piping needed during installation, says company. Standard equipment includes gages, compressor motor, belts, driving sheave, compressor flywheel, increment start, full size heat exchanger, operating charge of fluorinated hydrocarbon refrigerant.



Compressor . . .

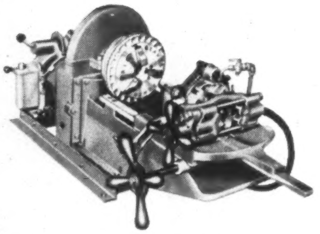
. . .engineered to supply oil-free air—*Gardner-Denver Co., Dept. HPAC, Quincy, Ill.*

"CACB" designed to provide air for operation of instrument controls, as well as for use in food processing, brewing, distilling, paint spraying, manufacturing applications. Heart of unit is said to be in carbon parts in cylinder which require no oil or water lubrication. Single-stage, air-cooled unit available base or tank mounted. For discharge pressures 40 to 100 psi.

Unit Heaters . . .

. . .for commercial, industrial applications—*Crane Co., Dept. HPAC, 836 S. Michigan Ave., Chicago* 5.

"Sunnyaire" units available in either hot water, steam, or gas fired versions. Heaters using hot water or steam furnished in two models: "Type H" for horizontal installation, "Type HV" for vertical or horizontal installation. Gas fired heaters furnished in models to burn natural, manufactured or mixed gas.



Pipe and Bolt Machine . . .

. . . with weight reduced to 260 lb—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

"Model-A" unit gives users portable weight factor of lighter machine with rugged performance of heavy duty pipe and bolt unit, says company. Reduction in weight accomplished with special aluminum alloy castings. Range of machine is ⅛ to 2 in. pipe, ¼ to 2 in. bolts, up to 12 in. with drive shaft and geared tools.

Electrodes . . .

. . . in general purpose, shielded arc, aluminum bronze type—*All-State Welding Alloys Co., Inc., Dept. HPAC,* 249-55 *Ferris Ave., White Plains, N. Y.*

For use with d-c reverse or high open circuit a-c. Recommended by company for braze welding cast iron, malleable iron, galvanized iron, cast iron to steel, cast iron to bronze, steel to bronze, others. Cited features: high strength, good corrosion resistance, wear resistance. In 1/8, 5/32, 3/16 in. diameters.

Room Air Conditioner . . .

. . . with "wet heat" coil—*Carrier Corp., Dept. HPAC, Syracuse* 1.

Designed to convert hot water and steam heating systems to air conditioning. "Console Weathermaker"

Insulation can be a White Elephant

It can clutter up a building site. And if it rains before the building's up . . . !

1000 ft
1000 ft
Storage Space Available

A 10' x 15' shack holds about a MILLION Sq. Ft. multiple aluminum insulation. Some bulkier insulations need 131 times the storage space.

Storage space at congested building sites is so scanty, that bulky materials must sometimes be left exposed to the weather, even to rain.

Pilferage and congestion cause expensive delays and become annoying problems. With compact, scientific multiple aluminum insulation, a few small 2 cu. ft. cartons, each holding 1000 sq. ft., tucked in a corner of a shed or tool bin, occupy negligible space. They can be taken to the job in the trunk compartment of a passenger car, or carried on a bus. *One* man can unload a passenger auto holding 10,000 sq. ft., in *minutes*. But it would take a *crew* HOURS to unload a freight car holding that much bulky insulation (about 250 bundles).

Light, clean and easy to handle, the average experienced applicator can install about 2,000 sq. ft. of multiple aluminum per day.

RESISTS HEAT AND VAPOR FLOW

Most important is PERFORMANCE: resistance to heat flow winter and summer; resistance to vapor flow and condensation formation which cause peeling paint, stained and crumbling plaster, rotting timber; and the loss of 1060 Btu's of latent heat with each pound of escaping vapor.

Metallic vapor barriers bar excessive passage of vapor from the warm side of walls and ceilings to colder spaces and surfaces, where it often condenses. (Cold air can hold less vapor in suspension than can warm air.) Water, from leaks and from soaking by driven rain, also gets in and evaporates; often recondenses.

Water vapor is a gas with about 1-millionth the density of water at 0°F. The invisible pores and apertures in many seemingly "solid" building materials are wide open spaces for the flow of vapor. Some materials may be waterproof and not vapor-proof. Being *metallic,* aluminum has almost zero permeability to vapor. Compared to outer walls and roofs, it has much less permeability than the ratio (1 to 5) required for efficient outward flow of vapor.

Aluminum has 97% reflectivity for Radiation, only 3% emissivity and absorptivity; and retards outer and inner Convection. Air spaces have low density, slight conduction.

Obtain *MAXIMUM* protection against heat loss and condensation with tough, *uniform-depth,* joist to joist multiple aluminum. It is continuous, up to 750 ft. long, without "breaks" every few feet.

What are the causes of condensation? How can you control it? The National Bureau of Standards brochure: "Moisture Condensation in Building Walls," helps you with these problems. (Use the coupon for free copy.)

THERMAL VALUES
Infra Type 4 Parallel Insulation

Down-Heat C .042*=7⅞" non-metallic insulation†
Up-Heat C .105*=3⅛" non-metallic insulation†
Wall-Heat C .068*=4¾" non-metallic insulation†

Cost installed between wood joists, material and labor, about 8¢ sq. ft.

Type 6 also available

Can be purchased everywhere through your preferred local dealer.

*Determined by method of National Bureau of Standards in H.H.F.A. Research Paper 32.
†Calculated on basis of limiting thermal values cited in Fed. Specs. LLL-f-321b; HH-I-585; HH-I-521c; HH-I-551a.

Infra Insulation, Inc., 525 Bway., N. Y. C. Dept. H-7
Send "Moisture Condensation in Building Walls."

NAME____________________

FIRM____________________

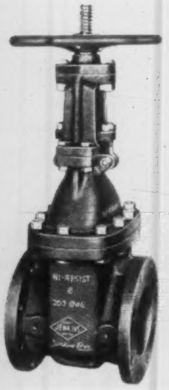
KIND OF BUSINESS____________________

ADDRESS____________________

EQUIPMENT DEVELOPMENTS

Continued

replaces radiator, and heating coil installed inside is connected to steam or hot water piping. All cooling equipment provided by air conditioner itself, while heat from coil is used to supply warm filtered air in winter, says company. Can be installed one room at a time without disturbing rest of heating system. In $^3/_4$, 1 hp sizes.



Valves . . .

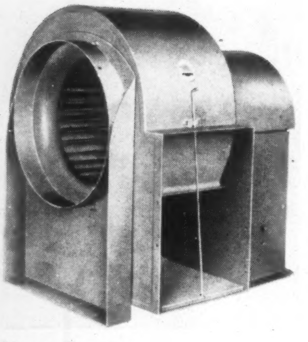
. . . for corrosive services—*Jenkins Bros., Dept. HPAC, 100 Park Ave., New York 17.*

"Ni-Resist Type 2" cast iron gate valves have type 316 stainless steel trim. Materials are said to show unusual resistance to corrosion, erosion in services that involve acids, salt and alkaline solutions, sea water, brine or other corrosive fluids, vapors or gases.

Air Cooled Chillers . . .

. . . with features designed to increase flexibility, facilitate installation—*American Coils Co., Dept. HPAC, Farmingdale, N.J.*

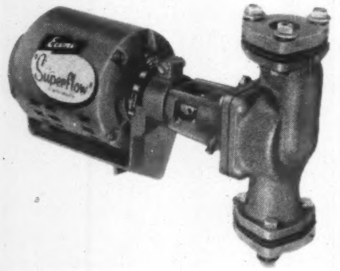
In two models: "ACI-AA" is self contained unit with compressor, chiller, air cooled condenser within one cabinet available in 2, 3, 5 hp sizes; "ACI-AR" is remote air cooled condenser available in sizes 3 to 15 hp. Recommended by company for use wherever wet cooling is called for in industrial processing, air conditioning.



Utility Sets . . .

. . . redesigned for compactness, easy drive accessibility—*American Blower Div. of American-Standard, Dept. HPAC, Detroit 32.*

"Sirocco" sets recommended by company for such applications as supplying or exhausting air in public buildings, schools, hospitals, hotels, apartment buildings, industry. Cited features of self contained units: very quiet multiblade wheel, accurate aileron control, welded steel construction, adjustable discharge, adjustable motor base.



Circulators . . .

. . . designed to deliver extra power, flow—*Econo Products Co., Div. of Viking Instruments, Inc., Dept. HPAC, East Haddam, Conn.*

"Super-Flow" engineered to meet increased demands of performance placed on circulators when installed in large or more complex baseboard, convector, radiant panel installations. "Magic Head" assembly is said to permit easy adjustment of head for installing circulator at any angle, also permits its use as either horizontal or vertical circulator. Interchangeable pipe connection flanges allow unit to accommodate any forced hot water heating system using pipe sizes $^3/_4$, 1, $1^1/_4$, $1^1/_2$ in., says company.

Fluid Cooler . . .

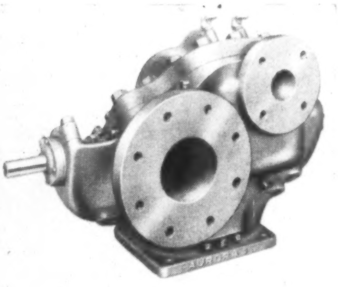
. . . in new induced draft, horizontal air discharge model added to company's line—*Trane Co., Dept. HPAC, La Crosse, Wis.*

Recommended by company for steam condensing, hydrocarbon condensing, jacket water cooling, oil cooling, gas cooling applications in gas transmission stations, refineries, chemical plants, natural gasoline plants. Available in nine sizes with capacities 1 million to 10 million Btu per hr.

D-C Welder . . .

. . . with new transformer, weld stabilized circuit, sealed semi-metallic rectifier—*Miller Electric Mfg. Co., Inc., Dept. HPAC, Appleton, Wis.*

"Gold Star SR" delivers maximum arc stability for greater metal deposition with all electrodes in all positions, says company. Machine is said to have higher short circuiting current, making it possible "to pinch the arc" in vertical and overhead welding.

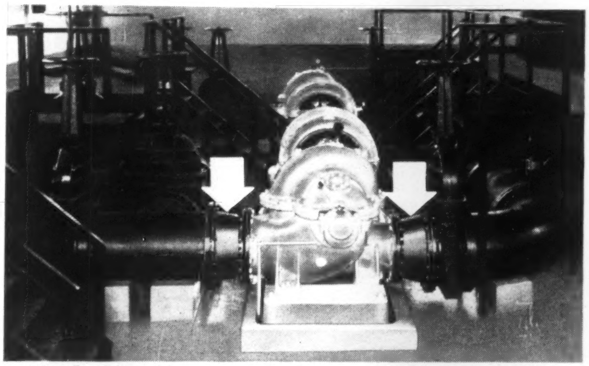


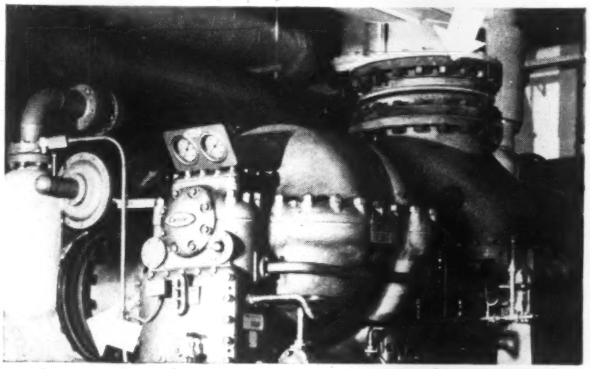
Centrifugal Pumps . . .

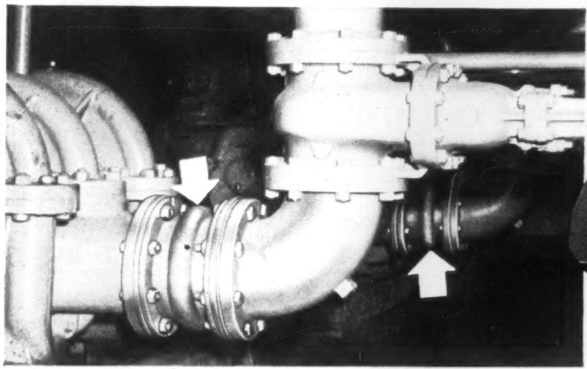
. . . with diagonally split case—*Aurora Pump Div., New York Air Brake Co., Dept. HPAC, 80 Loucks St., Aurora, Ill.*

EXPANSION JOINTS

Expanding the Designer's Scope


The flexible rubber expansion joints on the centrifugal pump installations (above) are made by U. S. Rubber. They prevent stresses caused by expansion and contraction.


This compressor has U. S. Expansion Joints on the suction and discharge lines. Like all U. S. Joints, these insulate against the transfer of vibration and noise.


Piping equipped with U. S. Expansion Joint to compensate for any misalignment caused by load stresses, wearing of parts or settling of building.

U. S. Rubber Expansion Joints are resilient and therefore do not, like metal, set permanently when compressed. Constant flexing merely keeps them alive... prevents brittleness.

- They absorb both axial and lateral deflection far more than metal joints. Greater insulation against vibration and pump noises. No electrolysis, corrosion or erosion.
- Handle pressures from 40 lbs. to 125 lbs.
- The outside diameter of the arch is smaller than on metal joints. (Face-to-face dimensions, even with multiple arches, are smaller.)
- Weight is much less. This, plus the fact that no gasket is needed between flanges (metal joints require gaskets) results in an easier installation lowering the cost.

"U. S." was the *first* to develop expansion joints. They are at work in every kind of industry, prolonging the life of equipment in pressure or vacuum pipe systems. Some are still in service, after 30 years of operation. Obtainable at any of the 28 "U. S." District Sales Offices, or write us at Rockefeller Center, New York 20, N. Y. In Canada, Dominion Rubber Co., Ltd.

For the complete technical information catalogue on the entire line of U. S. Rubber Expansion Joints, contact your nearest "U. S." District Sales Office or write us at Rockefeller Center, New York 20, New York.

Mechanical Goods Division

United States Rubber

FULL PENETRATION
new!
drop forged
BONNEY ELBOLETS*
with full penetration weld

ELBOW OUTLET
AND
45° BRANCH
CONNECTIONS
THREADED AND
SOCKET-WELD
ENDS

APPLICATIONS:
DIRECTIONAL FLOW
BRANCHES, THERMOWELL
CONNECTIONS, PIPE
SUPPORT AND HANGER
CONNECTIONS

Full penetration
weld drop
forged fittings
available
from stock in
the following
materials:

Carbon Steel
Stainless
Chrome Moly

Other materials
on quotation

*Pat. Pending

Outlet sizes to fit pipe sizes and long and short radius elbows	3000#	6000#
½	Stock	Stock
¾	Stock	Stock
1	Stock	Stock
1¼	Stock	Stock
1½	Stock	*
2	*	—

*will be available from stock

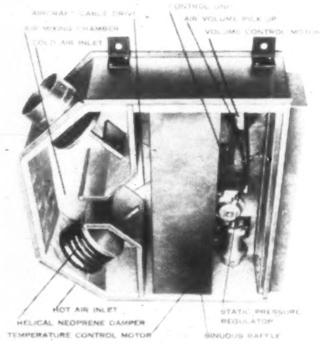
BONNEY

PENNSYLVANIA DIVISION
BONNEY FORGE & TOOL WORKS
Dept. C, Allentown, Pennsylvania

EQUIPMENT DEVELOPMENTS

Continued

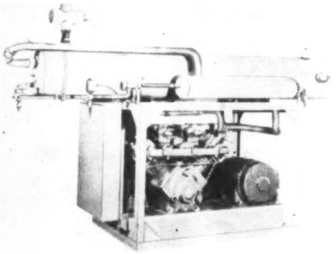
Cited applications include boiler feed service as well as hot or volatile liquids applications requiring low NPSH characteristics. 45 deg split allows both suction, discharge to be in bottom half of casing but above center line of pump, says company. Units are self venting, are said not to vapor lock. Available in water cooled stuffing box and water cooled bearing construction when required.


AIRCRAFT CABLE DRIVE
AIR MIXING CHAMBER
COLD AIR INLET
CONTROL UNIT
AIR VOLUME PICK UP
VOLUME CONTROL MOTOR
HOT AIR INLET
HELICAL NEOPRENE DAMPER
TEMPERATURE CONTROL MOTOR
STATIC PRESSURE REGULATOR
SINUOUS BAFFLE

Valve Attenuators . . .

. . . engineered as new departure in dual duct design—*Connor Engineering Corp., Dept. HPAC, Danbury, Conn.*

"Series 45" units are said to permit direct connection to any type of duct layout. Cited features include 45 deg inlets, helical neoprene dampers, aircraft cable drive, constant volume control, sinuous baffle. For capacities 140 to 1200 cfm. In above-ceiling, under-window models.



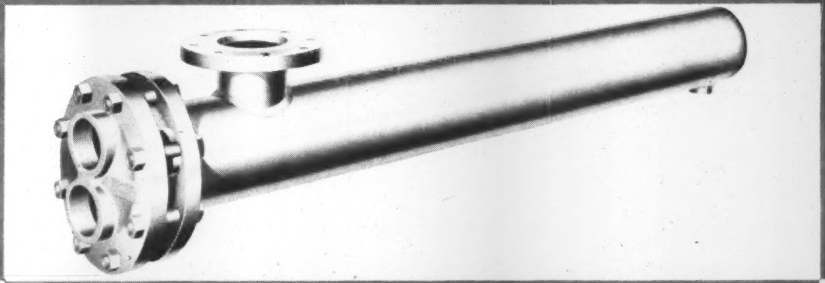
Water Chillers . . .

. . . for converting existing heating systems to air conditioning—*Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

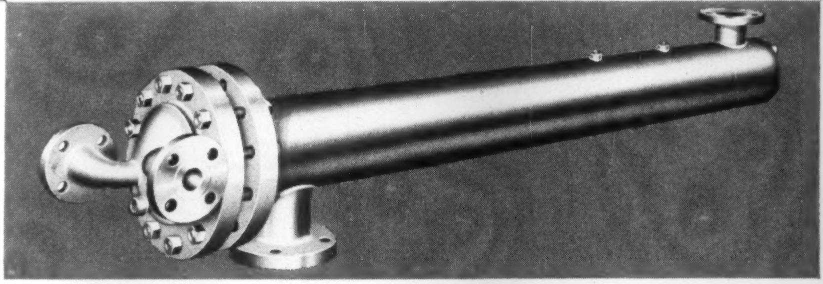
NEW FROM TACO

A STANDARDIZED LINE OF A. S. A. HEAT EXCHANGERS AND HIGH TEMPERATURE–HIGH PRESSURE CONVERTERS

For general applications, specify the Taco "L" or "S" series Heat Exchangers.



For High Temperature-High Pressure, specify the rugged new Taco HT series converters. Working pressures to 400 p.s.i. Operating temperatures to 450°F.



Both new lines of Taco Heat Exchangers are made under strict quality control production to A.S.M.E. code and A.S.A. flange standards.

TACO HEATERS, INCORPORATED

1160 CRANSTON STREET, CRANSTON, RHODE ISLAND

BETTER HEATING Taco BETTER WITH TACO

Corporate Office: 342 Madison Avenue., New York 17, New York
In Canada: Taco Heaters of Canada, Ltd., 4 Gilead Place, Toronto 2

CIRCULATOR • 170 PUMP • MP PUMP • FLOCHEK • AIR-SCOOP • TACO–VENT • TEMPERING VALVE • VENTURI

Please send me at no cost your new: H.P.

☐ Heat Exchanger catalog
☐ High Temperature-High Pressure converter catalog
☐ Both

NAME ______________________ TITLE ____________
COMPANY ______________________
ADDRESS ______________________
____

GREEN SURE SEAL*

AIR FILTER

MAXIMUM
EFFECTIVE
FILTERING AREA
FOR OVERALL
SPACE TAKE UP

All machines need foundations, bases, framework, and other parts that enclose or drive the effective working mechanism and go to make up the whole.

Air Filters are no exceptions.

If you need an air filter and are somewhat crammed for space, we suggest that you look into the merits of the GREEN *Sure Seal* AIR FILTER. Because of its unique design and method of supporting the feed and take up rolls, maximum effective filter area is provided. The entire surface of the filter media that is exposed is usable.

The area difference between the Sure Seal and conventional air filter may be only a few inches or feet, but it can make a big difference when trying to incorporate the unit in existing buildings or in new buildings where space and other structural factors must be considered. You will want the most filter area for the space taken up.

You can have confidence in the Green Line of products—which have been world-wide since 1845.

GREEN'S AIR FILTER

Our Bulletin #175 gives overall dimensions vs. capacity tables. Send for a copy and study this particular space-saving value.

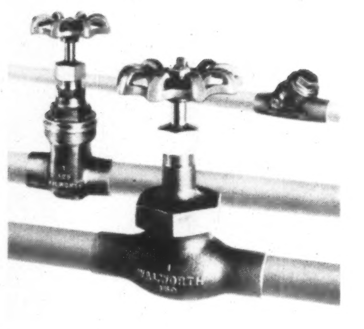
*U. S. Patents Pending

THE GREEN
POWER AND PROCESS PLANT EQUIPMENT
FUEL ECONOMIZER COMPANY INC.
BEACON 3, NEW YORK
Representative in Principal Cities

EQUIPMENT DEVELOPMENTS

Continued

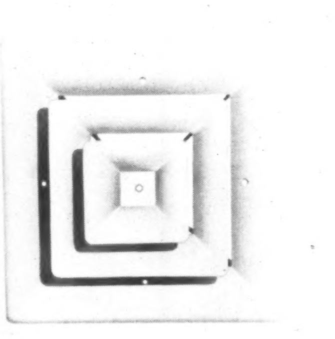
Packaged unit available in capacities 7½ to 75 hp. Cited advantage of "CWG" is cost saving factor of utilizing existing piping to pipe through for air conditioning cycle. Only chilled water connections, condenser water connections, electrical connections required to make units operative, says company.



Bronze Valves . . .

. . . for use on copper tubing—*Walworth Co., Dept. HPAC, 60 E. 42nd St., New York.*

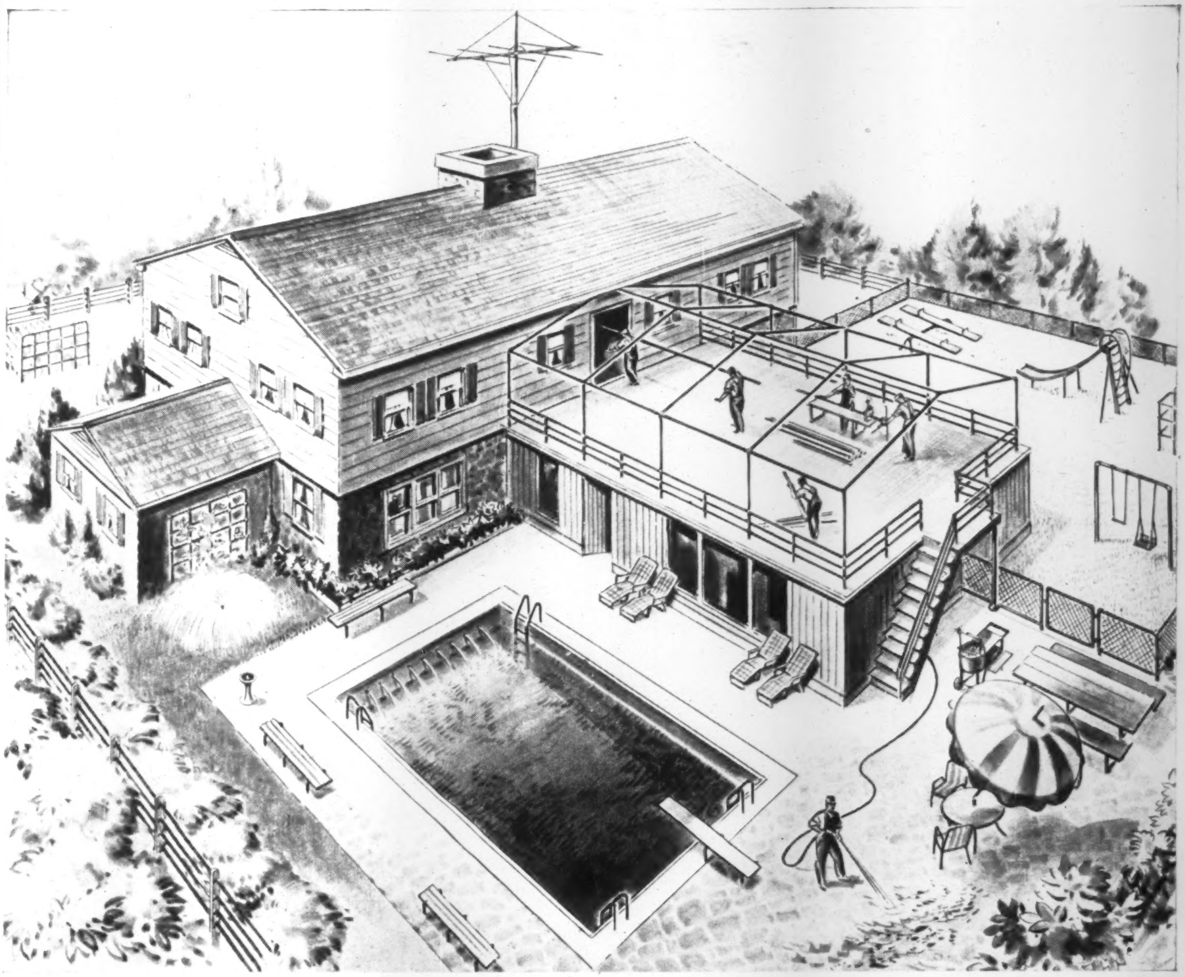
Bronze globe, gate, check valves designed with solder-joint sockets for easier installation on thin walled tubing. For use with K, L, M copper tubing used in steam, water, oil, gas service. "SJ" gate and check valves available in seven sizes ⅜ to 2 in. "SJ" globe valve comes in 10 sizes ¼ to 3 in.



Ceiling Diffusers . . .

. . . with square design—*Air Control Products, Inc., Dept. HPAC, Coopersville, Mich.*

"Model 90" diffuser offered in step-down style. Sizes available are



Remodeling Jobs Coming Your Way?

USE BETH-CO-WELD PIPE

Whenever a remodeling job comes along, chances are good you'll find several locations where steel pipe can be used to advantage. And as you know, where steel pipe is concerned, there's nothing finer than Beth-Co-Weld.

Beth-Co-Weld steel pipe is ideal for remodeling work because it's good, sound pipe, made by the continuous-weld process from an excellent grade of steel. It saves time, too, because it's so easy to cut, thread and weld.

Beth-Co-Weld is carried in black and galvanized by most jobbers, in standard and extra-strong weights, and in all popular sizes—everything from ½ in. up to and including 4 in. It is regularly furnished in 21-ft lengths, plus or minus 1 in., and is also obtainable in random lengths.

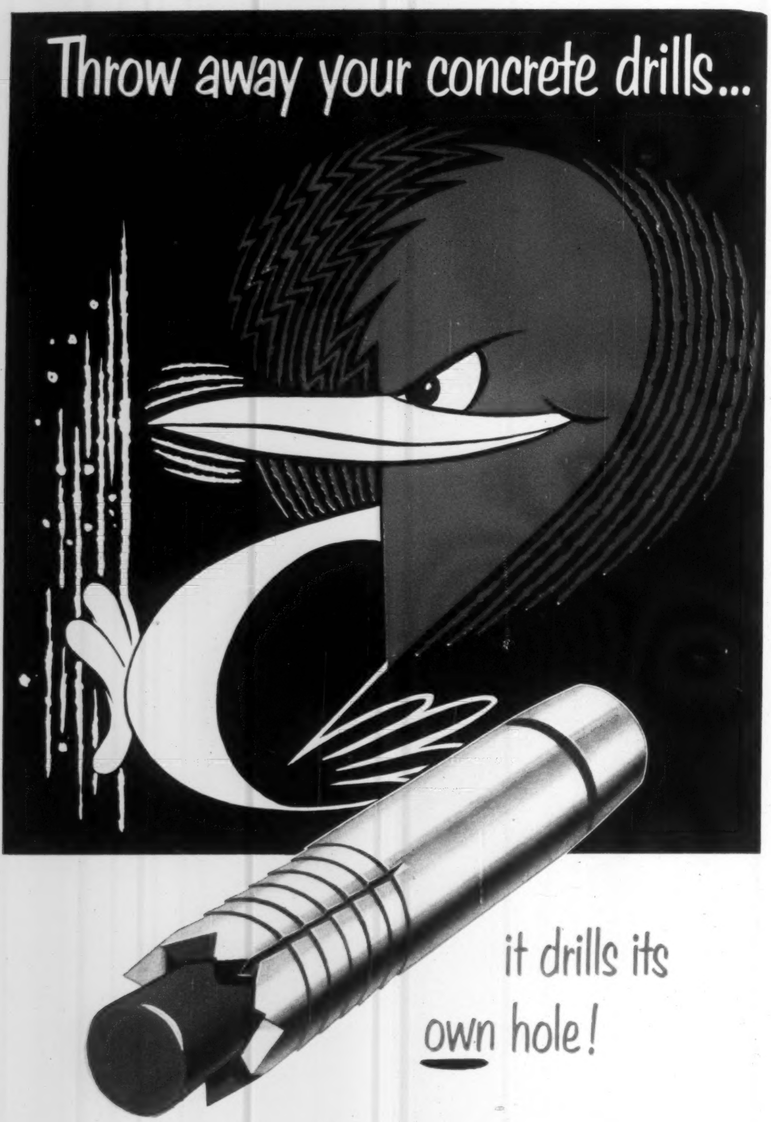
TYPICAL REMODELING JOBS
FOR BETH-CO-WELD

Structural Columns . . . Plumbing and Heating Lines . . . Conduit . . . Posts and Rails for Estate Fence . . . Gate Frames . . . Hand Railings Lawn Sprinkler Systems . . . Feed Lines for Swimming Pools . . . Awning Frames . . . Antenna Supports . . . Play Area Equipment

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL


Throw away your concrete drills...
it drills its own hole!

No expensive masonry drills or explosive charges needed. Every RED HEAD Concrete Fastener is its own drill! Installed by hand or impact hammer, the RED HEAD drills its way into the toughest concrete and ONCE IT'S IN...IT'S IN FOREVER! Can't pull out, rust out, melt out or shake loose. Costs less installed than any other means of concrete fastening. Write today for catalog and free sample Job site demonstration can be arranged.

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CONCRETE FASTENERS
the original *since 1916*
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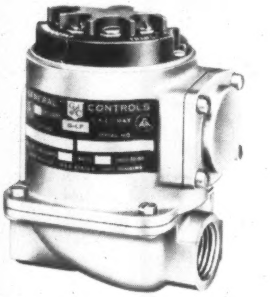
EQUIPMENT DEVELOPMENTS

Continued

6, 8, 10, 12, 14, 18 in. squares. Unit features series of squares and concentric rings in air foil design, with "antismudge" outer ring. With "push-pull" rod operated damper.



Solenoid Gas Valve . . .

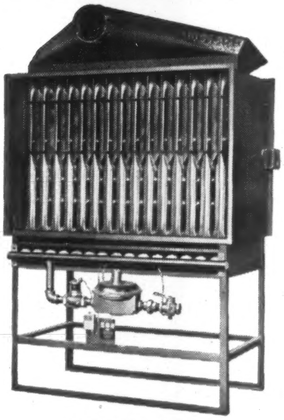
. . .engineered to combine simplicity of solenoid valve with silence of diaphragm valve by sealing all working parts in liquid filled, hermetically sealed head—*General Controls Co., Dept. HPAC,* 801 *Allen Ave., Glendale* 1, *Calif.*

"K-3H" reduces installation costs by eliminating bleed line; provides long, service-free life through permanently sealed operating components, says company. Designed for mounting in any position on horizontal pipe run.

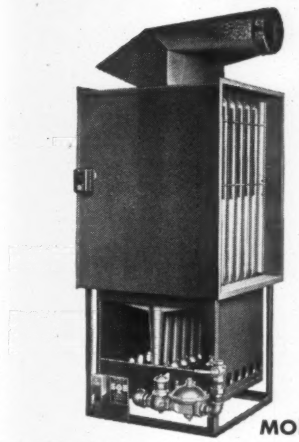
Forged Steel Union . . .

. . . now available with special heavy duty walls for power piping at higher pressures, higher temperatures—*Clayton Mark & Co., Dept. HPAC,* 1900 *Dempster St., Evanston, Ill.*

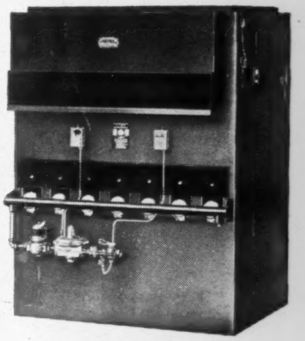
Recommended by company for severe service with gases, hot oils, water, steam, hot or cold ammonia. Wall thicknesses of 6000 lb CWP union, available in nine sizes, have



MODEL SED-E



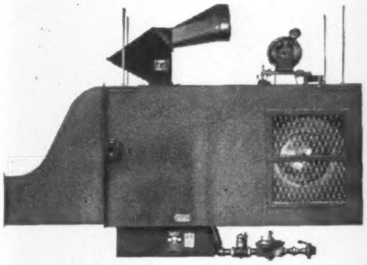
MODEL SED-S



MODEL SED-VF

MODEL SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation downstream of cooling equipment, for continuous blower operation. Air throughput in either direction. 80,000 to 600,000 Btu input.

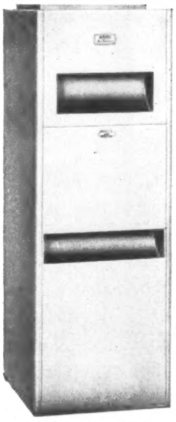
MODEL SED-S — Same as SED-E except controls are at the side, instead of at the end where accessibility requires. Either SED-E or SED-S is available in sizes from 80,000 to 600,000 Btu input in increments of 40,000 Btu.



MODEL SEU

MODEL SED-VF — Tested and approved as a duct furnace; type 32 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. Sizes from 70,000 to 245,000 Btu input.

MODEL SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 600,000 Btu input.



MODEL SEC

HAYES

FURNACES

outstanding for
commercial, industrial,
schools, churches,
theaters, large residential

HAYES FURNACE MFG. & SUPPLY CO.
3233 So. La Cienega Blvd., Los Angeles 16, California
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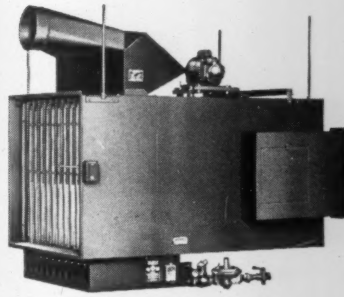


MODEL SES

MODEL SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower, glass or washable filters. 6 sizes — 70,000 to 245,000 Btu input. For zero clearance.

REPRESENTATIVES

M. Blazer & Son, Passaic, New Jersey.
Blue Flame Supply Company, Atlanta, Georgia
Eugene Bolstad, Edmonton, Alberta, Canada.
E. B. Bomar, Phoenix, Arizona.
Boyd Engineering Co., El Paso, Texas.
Reube O. Emery, Nashville, Tennessee.
F & D Distributors, Salt Lake City, Utah.
Leudecke Engineering Co., Austin, Texas.
McCombs Supply Co., Denver, Colorado.
O'Connor-Oklahoma Co., Oklahoma City, Tulsa, Oklahoma & Wichita, Kas.
Smith Steam Specialty Co., Kansas City, Mo.
Tay-Holbrook, Inc., San Francisco, California.
F. R. Young, Houston, Texas.
Dealers Supply Company, Atlanta, Georgia.
Jewell & Company, Hot Springs, Arkansas.
Nunn Electric Co., Lubbock, Texas.
Noland & Co., Newport News, Va.
Temp-Control Corp., Portland, Oregon

MODEL SES—Forced air, suspended furnace for installation in suspended duct system. Inlet and outlet designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

Randall

• quiet
• self-aligning
• self-lubricating

PILLOW BLOCKS

for Every Air-Moving Application

The unique design and flexibility of the exclusive Randall "DEEP-WELL"® ball assembly make it possible for Randall to supply the proper pillow block for every air-moving application.
Basic to every Randall Pillow Block is the "DEEP-WELL"® ball assembly containing a graphited cast phosphor bronze bushing, with Randall's exclusive graphite mixture. The graphite, in combination with supplemental lubrication, provides a perfect non-metallic cushion between the shaft and bearing surface. The large "DEEP-WELL"® reservoir automatically feeds the proper amount of lubricant to all parts of the bearing surface through porous graphite feed plugs and grooves—permitting extended operation without additional lubrication. Randall ball assemblies may be purchased separately for housings of your own design.

Available in a variety of standard housings and with different types of graphited or sintered bushings, Randall Pillow Blocks are designed so that alignment of the ball assembly with the shaft is automatic under all normal operating conditions. With the additional advantages of initial low cost and easier installation, you have good reason to contact your nearby Randall distributor. He's listed in the yellow pages of the telephone directory under "Bearings."

RANDALL—LEADING DEVELOPER AND MANUFACTURER OF THE AIR-MOVING INDUSTRY'S MOST DEPENDABLE BEARINGS

SEND FOR LITERATURE

RG2

Randall

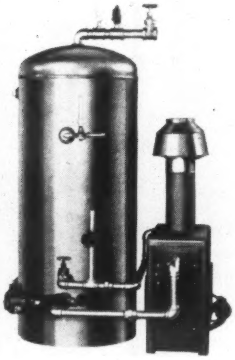
Clip this coupon to your letterhead, include your name and department and send it to Randall Graphite Bearings, Inc. We will send you the complete Randall Pillow Block Catalog.

RANDALL GRAPHITE BEARINGS, INC.
1012 S. Greenlawn Avenue, Lima, Ohio

EQUIPMENT DEVELOPMENTS

Continued

been increased substantially, says manufacturer. Rated 1500 lb steam working pressure at 900 F. Available in threaded and socket weld types.



Hot Water Systems . . .

. . . with "Strata-Temp" hot water storage tank feature—*Laars Engineers, Dept. HPAC, 13246 Saticoy St., North Hollywood, Calif.*

Tank is said to deliver more hot water at constant temperature than larger tanks. Feature enables tank to deliver almost its entire storage capacity without drop in outlet temperature, says company.

Steel Radiation . . .

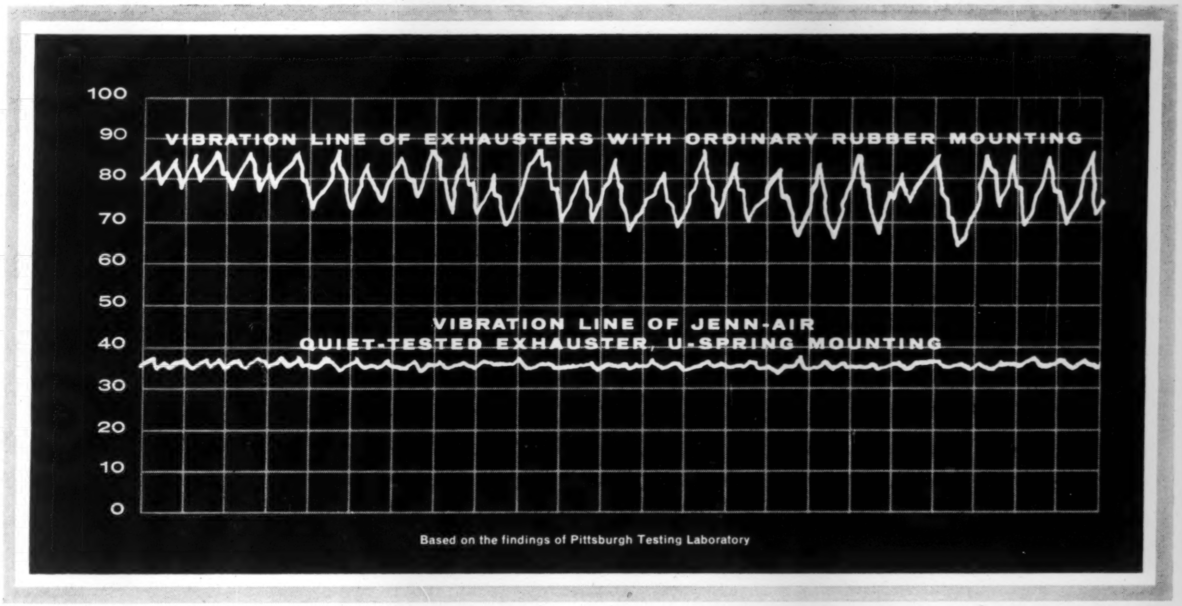
. . . for schools, commercial and industrial installations—*Crane Co., Dept. HPAC, 836 S. Michigan Ave., Chicago 5.*

Heating element fabricated of resistance-welded tubing, with steel fins attached in double-fold hub design facilitating full and constant contact with tube, says company. Three types of hangers offered and three types of enclosures available. Radiation comes in five sizes.

Air Handling Unit . . .

. . . designed for use in large applications such as factories, big retail stores, multistory office buildings—*Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles 22.*

"Model 580" has capacity of 35,000 cfm and 58 sq ft of coil face area covering cooling range to 100 tons.



Based on the findings of Pittsburgh Testing Laboratory

The above chart shows a comparison of vibration levels between ordinary exhausters and Jenn-Air Quiet-Tested Exhausters.

44% Less Vibration with JENN-AIR Quiet-tested Roof Exhausters!

Independent Laboratory Tests Prove Conclusively That Jenn-Air Quiet-Tested Roof Exhausters With U-Spring Suspension Show 44% Better Vibration Isolation Than Exhausters With Power Assembly Mounted in Rubber

Noise elimination is a problem which faces the ventilation industry today. To minimize the noise caused by vibration, Jenn-Air developed the Quiet-Tested Roof Exhauster with U-Spring cushion suspension. Now an independent laboratory offers proof positive this new principle of suspending the power assembly with U-Springs does the job. The PITTSBURGH TESTING LABORATORY, an independent research firm, was recently asked to compare Jenn-Air's Quiet-Tested Roof Exhauster, with U-Spring Suspension Mounting, against exhausters with ordinary rubber isolators. Tests were conducted under actual working conditions. Result: (see chart for dramatic evidence): *Jenn-Air Exhausters showed 44% less vibration transmission than the other exhausters.*

U-SPRING CUSHION SUSPENSION MOUNTING REDUCES VIBRATION . . . NOISE LEVEL

This innovation is another important improvement by Jenn-Air. It ensures against the major operating vibration and noise being transmitted through the duct work and into the building. The stainless steel also assures you the permanency of this quiet operation. Jenn-Air—and only Jenn-Air—Quiet-Tested Exhausters are proved under simulated field conditions. Each unit must pass rigid inspection by the critical *Vibronic Eye* . . . is 'screened' in Jenn-Air's Sound-Elec Test Chamber to detect noise and vibration.

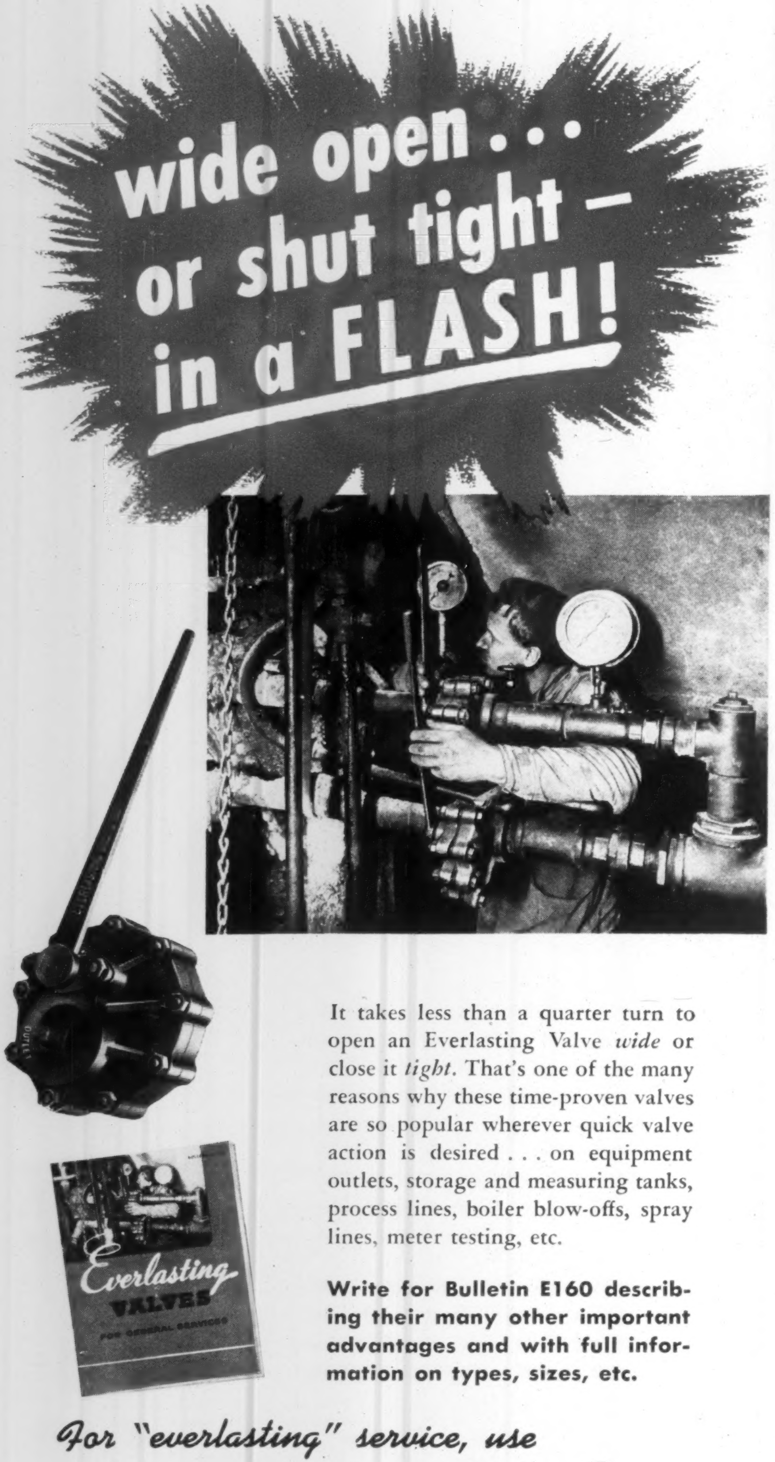
Patents Pending

Jenn-Air Quiet-Tested Roof Exhauster, with U-Spring Cushion Suspension Mounting. Note low contour design which complements modern architectural lines.

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive
Indianapolis 7, Indiana
HPAC
Gentlemen:
Please send me free catalog giving complete information on how Jenn-Air U-Spring Cushion Suspension Mounting cuts vibration, lowers noise level.

Name
Title
Company
Address
City State

JENN-AIR PRODUCTS COMPANY, INC.
1102 Stadium Drive • Indianapolis, Indiana



wide open . . .
or shut tight —
in a FLASH!

It takes less than a quarter turn to open an Everlasting Valve *wide* or close it *tight*. That's one of the many reasons why these time-proven valves are so popular wherever quick valve action is desired . . . on equipment outlets, storage and measuring tanks, process lines, boiler blow-offs, spray lines, meter testing, etc.

Write for Bulletin E160 describing their many other important advantages and with full information on types, sizes, etc.

For "everlasting" service, use

EVERLASTING Valves

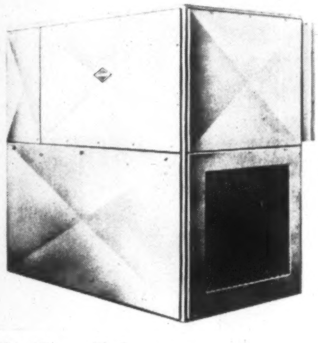
EVERLASTING VALVE CO.
61 FISK STREET, JERSEY CITY 5, N. J.

EV389

EQUIPMENT DEVELOPMENTS

Continued

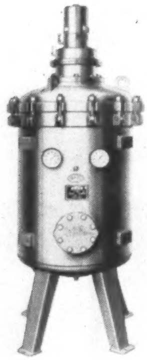
In three styles: vertical draw-through, horizontal draw-through, blow-through unit with individual zones.



Air Conditioners . . .

. . . in $7\frac{1}{2}$, 10, 15, $22\frac{1}{2}$, 30, 50, 60 hp models—*Drayer-Hanson, Div. of National-U. S. Radiator Corp., Dept. HPAC, 3301 Medford St., Los Angeles 63.*

"SCR" units have water cooled condensers. Recommended by company for industrial, large commercial applications. Cited feature is sectional construction, permitting remote location of condenser section if space is limited. Installation requires only three simple connections, says manufacturer.



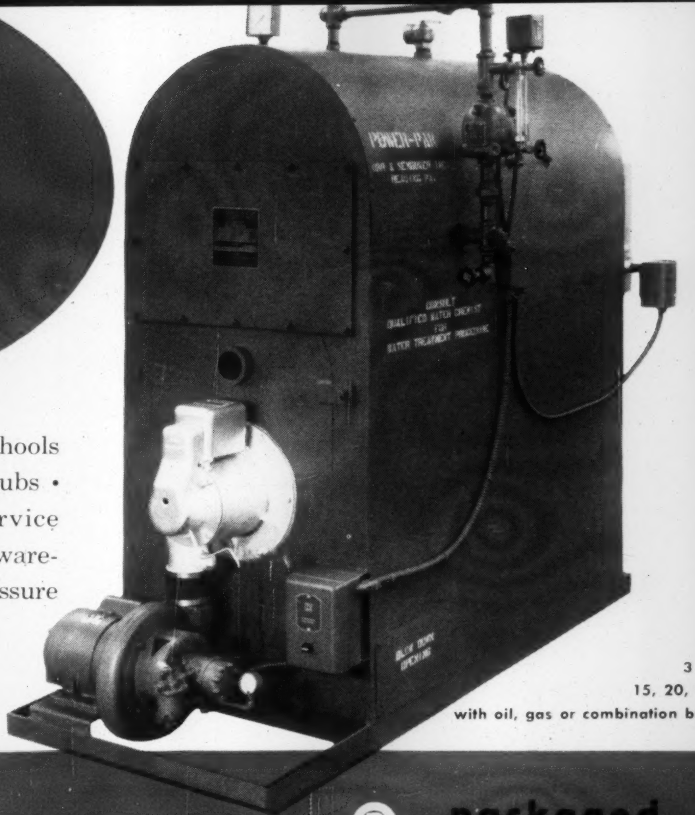
Oil Filter . . .

. . . with interchangeable filter elements—*Bowser, Inc., Lubrication and Filtration Div., Dept. HPAC, 1300 E. Creighton Ave., Ft. Wayne, Ind.*

Unit, when equipped with filter elements for lubricating oils and sim-

today's best boiler buy for **low-cost** heating for . . .

apartments • office buildings • churches • schools • markets • stores • motels • camps • clubs • restaurants • bakeries • garages • service stations • greenhouses • launderettes • warehouses • industrial plants • other low-pressure steam or hot-water heating needs


POWER-PAK
ORR & SEMBOWER INC.
READING PA.
CONSULT QUALIFIED WATER CHEMIST FOR WATER TREATMENT PROGRAMME
BLOW DOWN OPENING

3 SIZES
15, 20, 25 hp
with oil, gas or combination burners

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POWER-PAK®

packaged automatic boiler

QUICK DELIVERY from stock NOW!

Here's the boiler that will save you time, money, space and trouble in providing really low-cost, low-pressure steam or hot-water heating for a wide variety of commercial, industrial and institutional needs. Besides heating, POWER-PAK can supply hot water service (storage tank or instantaneous) for washrooms, kitchens and other utility outlets as required.

Multiple-unit installations offer attractive advantages over larger single boilers for heating loads above 25 hp. Many POWER-PAK units are now in service or ordered for widely different requirements where dependability, economy and freedom from attention are important considerations. Get the full story on POWER-PAK for new installations or replacements of heating boilers you may be planning now. Ask for Bulletin 1243.

money-saving advantages

- completely factory-assembled
- space-saving compactness
- time-saving installation
- factory fire-tested
- factory-insulated steel boiler
- fast steaming
- industrially-rugged burner
- 5 sq ft of heating surface per hp
- automatic operating and safety controls
- forced draft—no chimney needed
- clean, quiet operation
- easy over-all accessibility
- one-source responsibility for entire unit
- nation-wide factory-schooled service

Builders of Dependable Boilers Since 1885

ORR & SEMBOWER, INC.

Morgantown Road, Reading, Pa.

HOW TO SOLVE THE
3 BIG PROBLEMS
of Heating System Design

KEEP COSTS DOWN

The cost of Reznor unit heaters is comparable to or lower than that of other types of equipment of equal heating capacity. And with Reznor, this is the total cost. You don't have to add the costs of extensive piping and valves or duct work, and of radiators or registers. Reznor gas unit heaters produce and distribute heat at the point of need. To install them involves only suspension, venting and utility connections. So installation costs are much lower than those of central heating systems. Lower equipment cost . . . lower installation cost . . . two reasons why Reznor gas unit heaters can offer substantial savings on heating systems for so many commercial and industrial buildings.

SAVE SPACE

Reznor gas unit heaters are installed up at the ceiling, completely out of the way. When you design for a store or factory, you don't have to allot a single square foot of valuable space for heating equipment . . . and you don't have to keep floor or wall areas clear for radiators or registers.

INSURE FLEXIBILITY

When you specify Reznor gas unit heaters you don't have to choose between a heating plant which is over-sized and over-priced for current requirements and one which may not be adequate for future needs. With Reznor unit heating, when that new wing is added, additional heaters are installed. It's as simple as that. And in the case of internal remodeling, it's very easy and inexpensive to relocate the existing heaters.

ONLY REZNOR GAS UNIT HEATERS OFFER ALL THESE ADVANTAGES

- Clean, modern design, back as well as front . . . all controls and connections inside the cabinet.
- FlexiTemp control system with automatic two-speed fan control to provide nearly continuous air circulation and minimize temperature fluctuations (optional).
- No costly frills and gadgets . . . features which are needed only to meet special situations always separately listed and priced.
- Fan or blower models in ten sizes from 25 to 300 thousand BTU.

There is no "equivalent" for Reznor gas unit heaters.

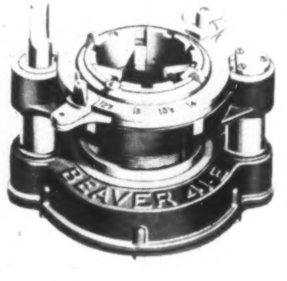
REZNOR
WORLD'S LARGEST-SELLING-DIRECT-FIRED
UNIT HEATERS
Reznor Manufacturing Company
51 Union St., Mercer, Pennsylvania

for complete details,
wherever you are . . .
Look for Reznor under "Heaters-Unit" in the Yellow Pages

EQUIPMENT DEVELOPMENTS

Continued

ilar liquids, is known as "Figure 822." When containing filter elements suited to coolants, is known as "Figure 823." Both types of elements interchangeable within filter case providing versatility for varied filtering requirements, says company.



Threader . . .

. . . with special aluminum alloy castings—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

Weight of "No. 41-E" geared unit reduced by approximately 40 percent. For use by hand or with power drives. Uses one set of dies for full range of 2½, 3, 3½, 4 in. Die cam may be set to cut standard, deep, or shallow threads of standard length. Both straight conduit and tapered threads can be made with same set of dies by making quick, simple adjustment, says company.

Room Air Conditioners . . .

. . . in new line of water cooled models—*Remington Air Conditioning Div., Remington Corp., Dept. HPAC, Auburn, N. Y.*

"Consolaire" line consists of three models rated 1 to 1½ hp. Recommended by company for interior spaces for which air cooled units are impractical, locations in zones where climate is too severe for air cooled units, at seashore where air cooled units would "rust out."

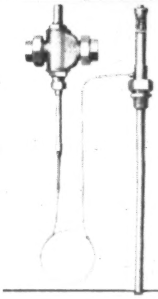
Dust Collector . . .

. . . designed to have small size, high efficiency—*Joy Mfg. Co., Dept. HPAC, Oliver Bldg., Pittsburgh 22.*

"Microdyne" is said to be 1/10 to

Low-cost Temperature Control—by SARCO

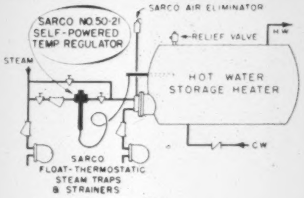
Self-Powered and Electric Indicating



Sarco Temperature Controllers Self-Powered . . . Fully Modulating

Simple as ABC . . . a thermostat with capillary tubing and a valve. That's all! Operated by liquid expansion. Automatic. Self-powered . . . no electricity or compressed air required. Self-contained . . . no exposed mechanism. Packless valve . . . no stuffing box to leak or stick. Easy to install by any pipefitter.

Furnished with thermostats suitable for any liquid or for air in dryers, ovens, air ducts, etc. Valve sizes . . . ½ to 6″. Temperature ranges to 300°F. *Bulletin 620-2.*

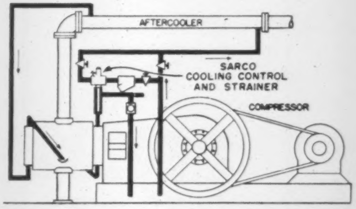

SARCO AIR ELIMINATOR
SARCO NO.50-21 SELF-POWERED TEMP REGULATOR
RELIEF VALVE
H W
STEAM
HOT WATER STORAGE HEATER
CW
SARCO FLOAT-THERMOSTATIC STEAM TRAPS & STRAINERS

Typical applications: **Shell and tube heat exchangers; condensers, oil storage tanks, dryers, etc.**

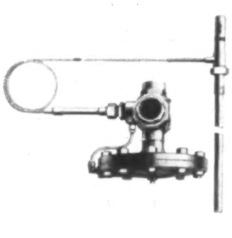
Sarco Cooling Controls Self-Powered . . . Fully Modulating

Simple, compact, automatic thermostatic valve. Eliminates overcooling and undercooling. Saves water. Overall height of ¾″ size is only 17⁷⁄₁₆″. Self-powered . . . requires no electrical or compressed air hook-up. Valve and bulb all in one unit. No exposed mechanism. Single-seated packless valve . . . not affected by silt or scale-forming minerals.

Valve sizes . . . ⅜ to 1½″. Temperature ranges between 40° and 210°F. *Bulletin No. 710-B.*


AFTERCOOLER
SARCO COOLING CONTROL AND STRAINER
COMPRESSOR

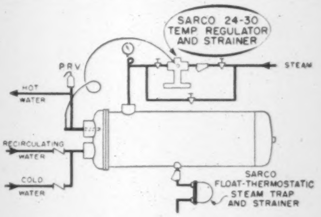
Typical applications: **compressors, small engines, water-cooled bearings, condensers, dry cleaning stills, etc.**



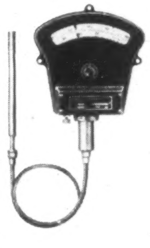
Sarco Temperature Controllers Self-Powered . . . Single-Seated, Tight-Closing

A simple, self-powered automatic temperature controller with diaphragm-operated, pilot-controlled valve. Designed for intermittent service or service involving long periods with practically no call for steam. Self-powered by liquid expansion . . . no electricity or compressed air needed. Packless.

Valve sizes . . . ½ to 3″. Temperature ranges to 300°F. *Bulletin No. 625-B.*


SARCO 24-30 TEMP REGULATOR AND STRAINER
PRV
STEAM
HOT WATER
RECIRCULATING WATER
COLD WATER
SARCO FLOAT-THERMOSTATIC STEAM TRAP AND STRAINER

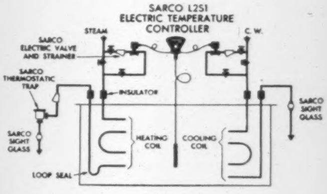
Typical applications: **instantaneous heaters, fuel oil pre-heaters, high pressure applications on hot water storage tanks.**



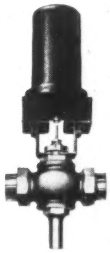
Sarco Electric Temperature Controllers Indicating Type

Simple, inexpensive, electric-indicating automatic temperature controller. Sensitive enough to perform many of the functions of much more elaborate recorder-controllers, at a fraction of their cost. Responds to changes of ± ½°F. Adjustable. Large, easy-to-read scale shows both actual and set temperatures.

Temperature ranges between minus 90° and plus 650°F. Offers many sequence combinations such as step-heating. *Bulletin 1025-B.*


SARCO L2S1 ELECTRIC TEMPERATURE CONTROLLER
STEAM
C. W.
SARCO ELECTRIC VALVE AND STRAINER
SARCO THERMOSTATIC TRAP
INSULATOR
SARCO SIGHT GLASS
HEATING COIL
COOLING COIL
SARCO SIGHT GLASS
LOOP SEAL

Typical applications: **plating tanks, processing vats, kettles, chemical tanks, etc.**



Sarcostat Hydraulic Motor Valves Electrically Operated

For remote control by hand or thermostat. Open and shut operation. Can be equipped with semi-modulating mechanism. Powerful hydraulic action operates valves up to 5″ single-seated, or 8″ double-seated, at pressures up to 175 psi. Ruggedly constructed . . . to withstand severe use without constant supervision and with minimum maintenance. Operates in any position.

For direct connection to 110 volts A. C., 60 cycle current. Valve sizes . . . ½ to 5″ single-seated; ½ to 6″ double-seated. *Bulletin 1080-A.*

UNDIVIDED RESPONSIBILITY

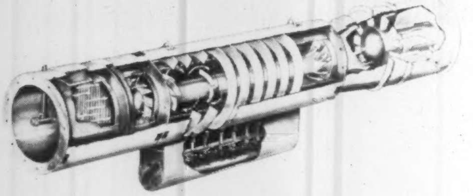
From one "Complete Line" source . . . SARCO-SARCOTHERM . . . for temperature controllers, steam traps and other heating specialties.

2230-B

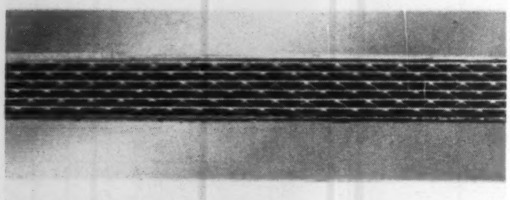
Write for Bulletins to—Sarco Co., Inc., Empire State Bldg., New York 1, N.Y.

EQUIPMENT DEVELOPMENTS

Continued



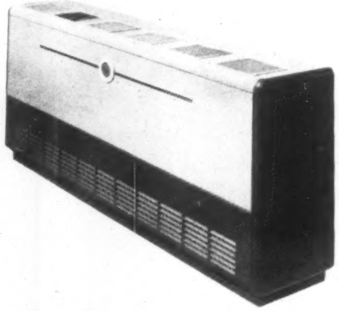
1/20 size of comparable equipment. Has efficiency of 99+ percent in collecting particles 5 microns or larger, says company. Units available in rated capacities to 64,000 cfm.



Long Slot Diffuser . . .

. . .designed to be able to direct air into room at approximately 90 deg to face of diffuser—*Universal Diffuser Corp., Dept. HPAC, Tuckahoe, N. Y.*

"Line-Air" can be placed directly onto duct in long continuous strips without requiring equalizing deflector blades, says company. Air leaving unit is broken-up into counter-current jets, preventing stratification. Recommended by manufacturer for supplying warm air barrier on large window spaces.



Electric Unit Ventilator . . .

. . .for school classrooms—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

Unit uses electric heating coil and combines advantages of company's "Draft/Stop" system of classroom cooling, heating and ventilating, with low cost, rapid installation of electric heating, says company.

Everybody NEEDS THIS NEW REED CHAIN WRENCH

Ratchet action works either way from either side

HARDENED TOOL STEEL JAWS ARE REPLACEABLE

TURNS ANY SHAPE
Round ● Square ■
Hex ⬢ Odd

IDEAL FOR CLOSE QUARTERS

works where an ordinary pipe wrench won't!

The Reed DU-ALL Chain Wrench does everything a conventional pipe wrench will do, and a great deal more. It gets into tight corners, close to baseboards or between parallel pipe lines, and holds round, square or irregular shapes . . . firmly, without "play" or crushing.

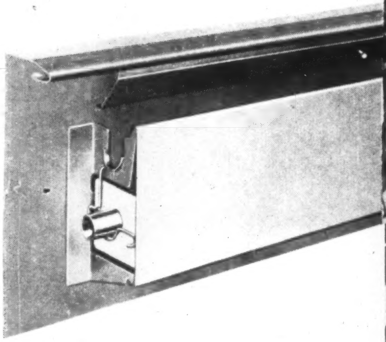
Its fast, ratchet action lets you tighten and "back off" without taking the wrench from the pipe.

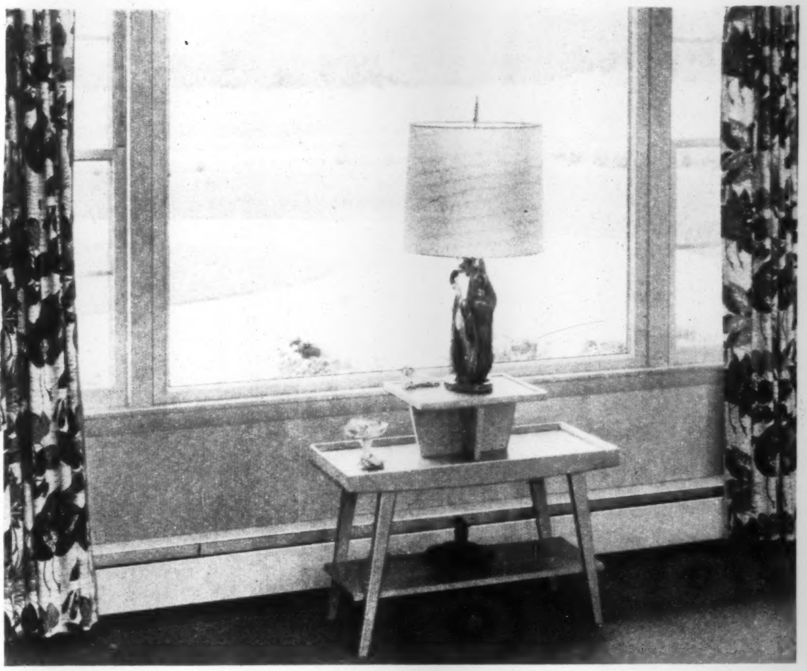
All sizes of the DU-ALL wrench have ample chain length for fully tightening pipe up to the diameters handled by ordinary wrenches of equal lengths. Additional chain in the 14″ model, however, gives the wrench a full working capacity up to 2″ pipe and a holding capacity up to 4 inches. This is a major convenience in lining up soil pipe stacks, straightening studs, setting posts or turning any irregular shape within the leverage range of the 14″ handle.

Whenever you want to work with pipe . . . ask for a REED Pipe Tool!

REED MANUFACTURING COMPANY • Erie, Pennsylvania

Simple construction of Perimaheat makes fitting quick and easy. Front cover snaps into place without screws, yet is easily removed for access.





Attractive view of this living room illustrates how well Perimaheat blends into a well designed interior.

Perimaheat® BASEBOARD CONVECTORS BY Young

Blend into the beauty of the modern interior

Designed to work inconspicuously against the background of the contemporary interior, Perimaheat offers perfectly controlled baseboard convection heating that is *low in cost, high in performance* and *installed with ease.* For homes, offices and institutions.

Complete information and data about Perimaheat may be obtained from your nearest Young Radiator Company representative — see yellow pages of your telephone directory — or by writing to Young Radiator Company, Dept. 517-G, Racine, Wisconsin.

Check these advantages:

Attractive Styling — Perimaheat's slim enclosure needs little floor space, permits freedom of furniture grouping and blends well into the design of any room.

Ease of Installation — Installed either surface mounted or partially recessed, Perimaheat is packaged in convenient lengths insuring minimum waste and quick, easy installation.

Minimum Cost — Low cost of Perimaheat makes possible the installation of a more comfortable, cleaner hot water heating system at a cost no greater than that of a well designed but less desirable forced warm-air system.

Rapid Warm-up — Lightweight nonferrous core responds quickly to thermostatic control. No lag in heating-up or over-run after desired temperature is reached, insuring maximum fuel economy.

Maximum Capacity — High capacity heating unit provides maximum output with a minimum of length. It is seldom necessary to install Perimaheat on more than one or two walls of a room.

Piping Economy — Perimaheat heating element serves as a main in the often used loop or series loop circuits. Most homes require only one or two loops which eliminate mains, fittings, etc.

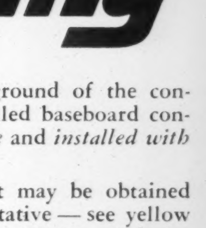
Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

Write Dept. 517-G for catalog 4354-A



perimaheat

BASEBOARD CONVECTORS

YOUNG

YOUNG RADIATOR CO

Looks tough . . . but it's easy with Ramset®

Once other contractors have cluttered up the work area, going back to remodel or finish a job is tough—unless you use RAMSET® FASTENING SYSTEM.

RAMSET reaches the hard-to-get-at places easily. One hand operation makes ladder and scaffold work simple. Does an hour's fastening in five minutes!

RAMSET is entirely self-contained. No hose, wires or equipment to drag. Perfect for restricted places. Makes the tough jobs easy.

There's a RAMSET dealer near you, ready to supply you and service your needs. Call him (yellow pages under Tools). Send for new catalog now ready.

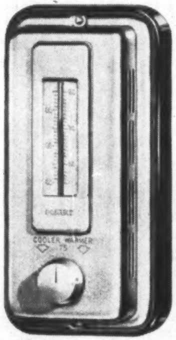
companion tool
Shure-Set®
a hammer-in tool that uses no cartridge, but makes your hammer power more effective. For masonry, mortar joints, cinder blocks. Ask for catalog.

Ramset Fastening System
WINCHESTER-WESTERN DIVISION
OLIN MATHIESON CHEMICAL CORPORATION

12109-G BEREA ROAD • CLEVELAND 11, OHIO

EQUIPMENT DEVELOPMENTS

Continued



Thermostat . . .

. . . engineered for rapid, positive changeover between heating and cooling cycles—*Powers Regulator Co., Dept. HPAC, 3434 Oakton St., Skokie, Ill.*

Instrument uses relay and flapper valve said to make it impossible for action to linger "in between" when supply pressure is changed. Other features include ball supply-exhaust valve assembly for greater air capacity, user-adjustable temperature differential for economy in cooling cycle, says company.

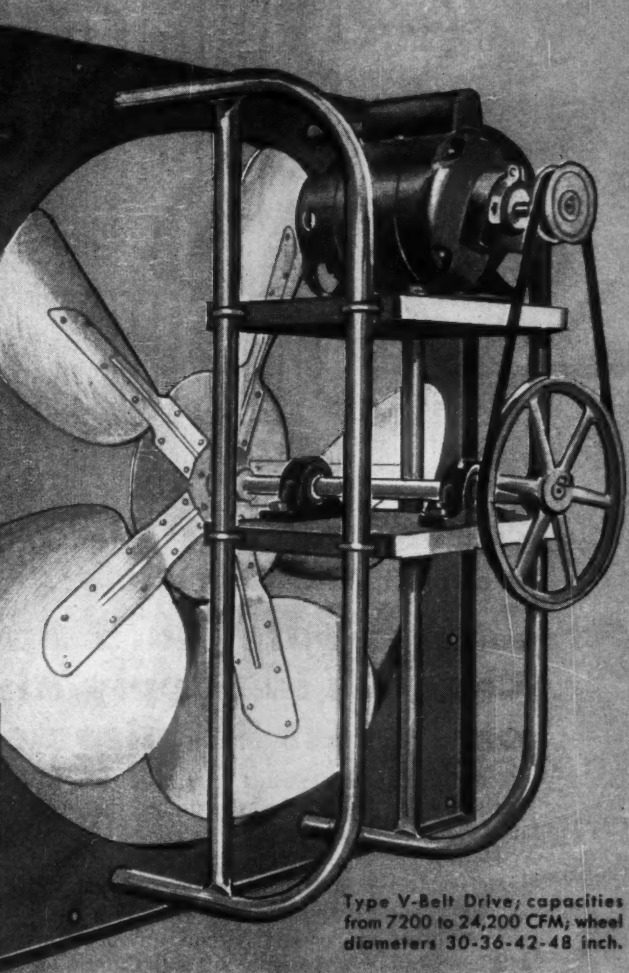
Hand Swivel Drill Motor . .

. . . designed as compact, portable, ruggedly built combination for high speed drilling in all types of masonry materials to provide space for piping, etc.—*Water Swivel Div., Wheel Trueing Tool Co., Dept. HPAC, 3200-182 W. Davison Ave., Detroit.*

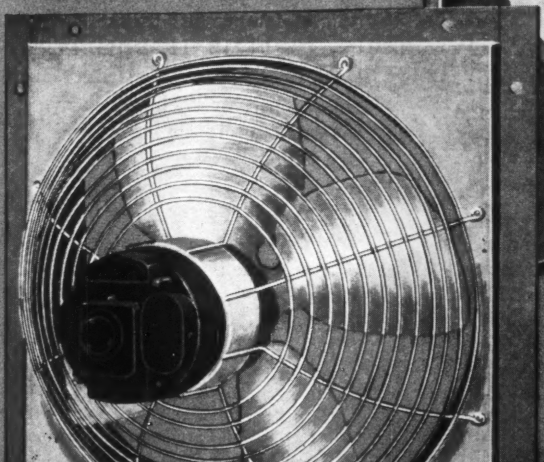
Combination consists of 1000 rpm drill motor with integral water swivel which supplies water to cutting face of diamond drill to flush away cut-

PROPELLER FANS

. . . for handling large volumes of air at low resistance . . .



Type V-Belt Drive; capacities from 7200 to 24,200 CFM; wheel diameters 30-36-42-48 inch.



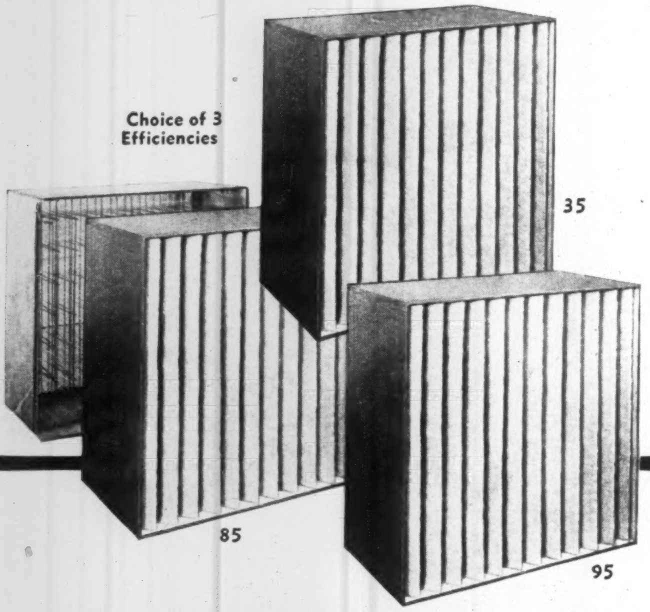
Type Direct Drive; capacities from 610 to 6,000 CFM; wheel diameters 10-12-15-18-20-24 inch.

Outstanding performance records reflect the advanced engineering and quality construction that have made these propeller fans leaders in the field . . . efficient performance and low current consumption . . . all wheels machine-balanced for quiet, smooth, vibrationless operation . . . square venturi panel . . . in two types and 10 basic sizes . . . write for bulletin 564.

nyb

THE NEW YORK BLOWER COMPANY

SALES OFFICES: 3149 SOUTH SHIELDS AVENUE • CHICAGO 16



Cambridge AEROSOLVE® Filter Cartridges are INTERCHANGEABLE

...Your Safeguard against Changes in Supply Air... or Process Requirements

Even if you know the exact amount of each type of dirt in the supply air, you have no assurance that it won't change next month or next year.

Even if you know exactly how clean the air must be for your comfort conditioning or process, you can't be sure what the future requirements will be.

With other air-cleaning systems, any necessary change in efficiency can be very costly. But with Cambridge AEROSOLVE Filters, it is simply a matter of substituting filter cartridges of higher or lower efficiency as required. No further changes in the filter system are necessary.

Or you might find that inexpensive pre-filters, which can be added at any time, will be economically advantageous.

High Efficiency at Low Cost

The annual owning and operating cost of Cambridge AEROSOLVE Filters is only a fraction of the cost of other high-efficiency filtration equipment, so that practical consideration can now be given to high efficiency on all process and comfort conditioning jobs.

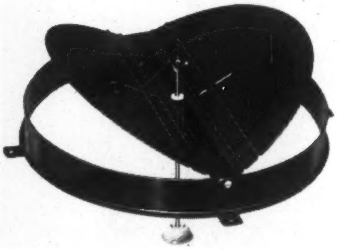
Write for Bulletin 120

Cambridge Filter Corporation
738 E. Erie Blvd., Syracuse 3, N. Y.

Also Makers of the Famous ABSOLUTE® Filter — World's Most Efficient Air Cleaning Device

REPRESENTATIVES IN PRINCIPAL CITIES

tings. Water fitting may be connected to any ordinary supply line and, on jobs where running water is not available, may be hooked up to portable pressure water tank. For use with diamond drill bits 1 to $3\frac{1}{2}$ in. diameter.



"Push-Pull" Dampers . . .

. . .for ceiling diffusers—*Air Control Products, Inc., Dept. HPAC, Coopersville, Mich.*

"Model 78" round damper fits all of company's round diffusers in sizes 6, 8, 10, 12, 14 in. "Model 91" square damper fits square diffusers in 6, 8, 10, 12, 14, 18 in. squares. Dampers are rod operated, with plastic operator knob, which may be removed to prevent tampering with any setting.

Valves . . .

. . .constructed of titanium—*Fabri-Valve Co. of America, Dept. HPAC, Portland, Ore.*

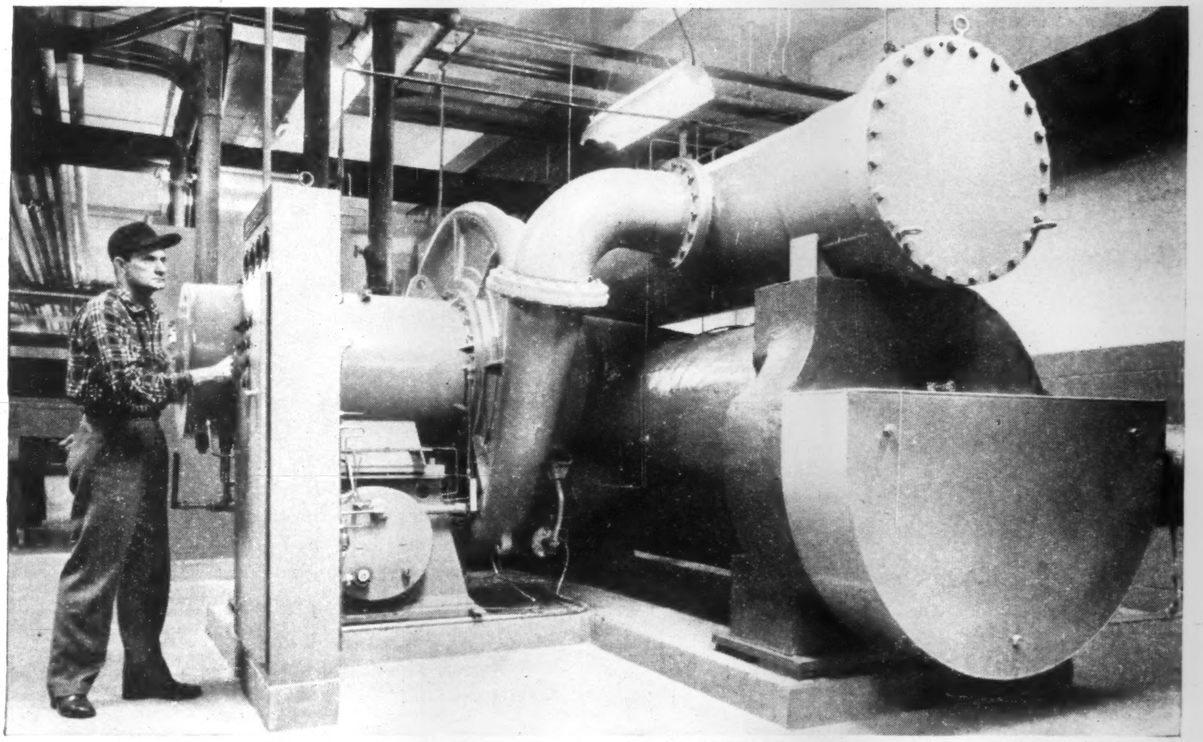
Titanium is said to have toughness, lightweight, corrosion resistant qualities which will greatly reduce maintenance costs. Cited applications include pulp and paper, chemical, oil, other industries.

Abrasive Cutter Wheel . . .

. . .for use on company's Nos. 14 and 20 "Speed-Cut" abrasive cutoff machines—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

Glass fiber reinforced unit designed for cutting ferrous material. Is said to be break resistant, have greater resistance to side pressure. Sizes are 14, 20 in. diameter with 1 in. arbor.

AMERICAN BLOWER AIR CONDITIONING



New Orleans Federal Office Building's Tonracs maintain constant chilled-water temperature — regardless of load.

Tonrac provides air-conditioning load variations from 0 to 100% in New Orleans Federal Building

UNITED STATES OF AMERICA

Teamwork like this brought effective air conditioning to the Federal Office Building, New Orleans. L. to r.: I. A. Lindberg, American Blower; G. M. Graf, group supvr., General Services Administration; E. A. Stack, chief engineer, Federal Building; G. A. Hero III and A. A. Hero, Comfortair Co.

To provide controlled indoor comfort, the U.S. Government installed air conditioning in their New Orleans Federal Office Building.

For the heart of the system, they chose two 300-ton American Blower TONRAC® centrifugal refrigeration machines. Here's why, in the words of Alvin Hero, president, Comfortair Company, Inc., New Orleans air-conditioning contractors:

"After inspecting available units, Tonracs were selected because they were found to be most flexible, easy to install; and they met and exceeded government requirements.

"In this installation, humidity control was the primary factor. Not only was it necessary for the Tonracs to operate at full capacity, but the lower variable — below 10% of capacity — was equally important to keep humidity low at night and during week ends."

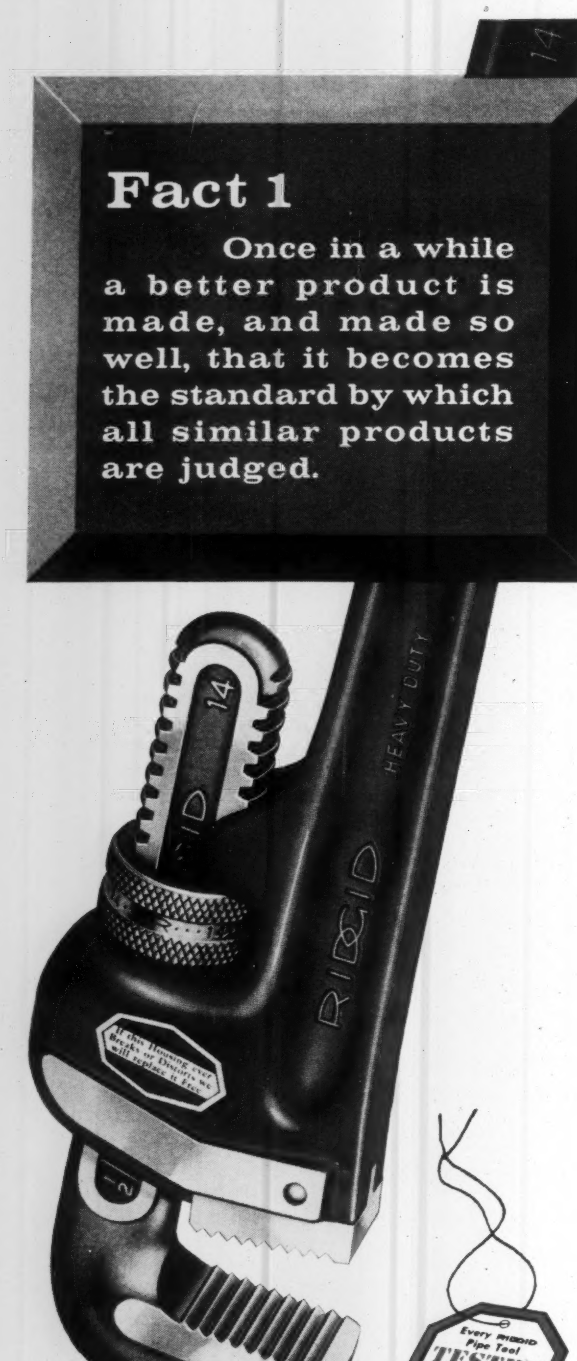
If your client's building or remodeling plans include air conditioning, why not call in an American Blower representative at the *planning* stage? American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of **AMERICAN-Standard**

American-Standard Products

Air conditioning equipment for every business


14
HEAVY DUTY
RIDGID
14
If this Housing ever Breaks or Distorts we will replace it Free
Every RIDGID Pipe Tool TESTED individually before shipment

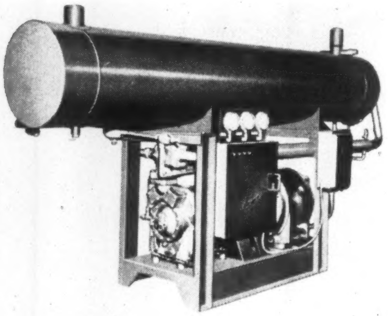
Fact 1

Once in a while a better product is made, and made so well, that it becomes the standard by which all similar products are judged.

Fact 2

The preference that you and millions of other users have shown for the RIDGID Pipe Wrench puts on us the responsibility of keeping it always up to the top quality you expect of it.

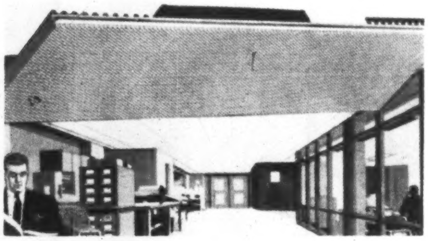
The Ridge Tool Company, Elyria, Ohio, U. S. A.



Packaged Liquid Chillers . . .

. . . in nine model series rated 20 to 125 tons—*Acme Industries, Inc., Dept. HPAC, Jackson, Mich.*

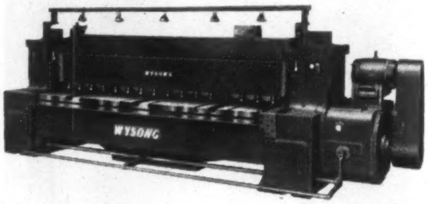
Cited features of direct-drive "Flow-Therm" units are efficiency, compactness, dependability, versatility. Units become heat pumps with factory installed changeover valves. Innovation is completely enclosed, "tamperproof" control panel of improved design complete with warning lights, says company. Door can be locked.



Ceiling Air Diffusers . . .

. . . for modular installation with tile ceilings—*Air-Factors, Inc., Dept. HPAC, Monrovia, Calif.*

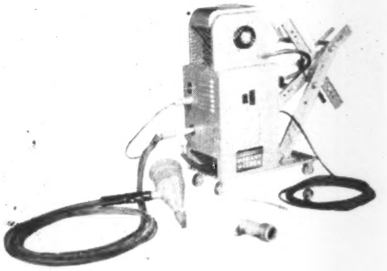
"Series MO-MJ" units designed to introduce conditioned air through openings that blend with modern architectural treatment of ceilings. Outlets available in all square and rectangular sizes, says company.



Power Squaring Shears . . .

. . . with capacity of $\frac{3}{8}$ in. mild steel, cutting lengths of 6, 8, 10 ft—*Wysong & Miles Co., Dept. HPAC, 625 Fulton St., Greensboro, N.C.*

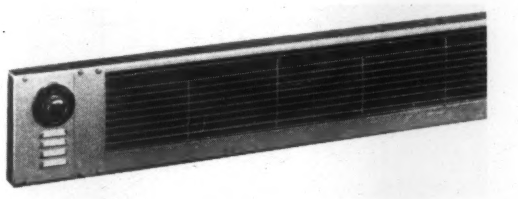
Cited feature of unit is massive, high tensile castings used in construction. Is said to provide greater rigidity, less vibration, and maintain greater accuracy during long runs of capacity shearing. "Rugged" 36 in. range back gage designed to swing up, permit shearing beyond 35 in. range of gage.



Semi-Automatic Welding Unit . . .

. . . with compact, lightweight design—*Hobart Bros. Co., Dept. HPAC, Troy, Ohio.*

Equipped with all controls, control power cable for plugging in on 110 volts (a-c or d-c), wire reel, caster mounted base, carrying handles. Gun cable assembly included with two welding guns, which are interchangeable—one flux type with hopper, one open arc type for welding without flux.



Baseboard Glass Radiant Heaters . . .

. . . designed to extend only $1\frac{3}{4}$ in. without being recessed—*Berko Electric Mfg. Corp., Dept. HPAC, 212-40 Jamaica Ave., Queens Village, N.Y.*

Cited features for 650 watt system: new baseboard level thermostat which can control up to seven 650 watt heater sections, duplex electrical outlet section, 90 deg internal corner section, wire raceway at bottom of unit to accommodate and simplify wiring. Rated 240 volts, 2218 Btu.

Self Supporting Batting . . .

. . . for thermal insulation, liquid and gaseous filtration, vibration and shock absorption, other applications—*Star Woolen Co., Dept. HPAC, Cohoes, N.Y.*

"Ny-Sul-Loft" made of nylon fibers. Is said to resist fungus and mildew attack, be rapid drying and resist alkalies and most acids. Will withstand continuous temperatures to 300 F, says company. In weights 2 to 8 oz per yd. Available in any width to 55 in.

RIDGID
2-S
Every RIDGID Pipe Tool TESTED individually before shipment
RIDGID

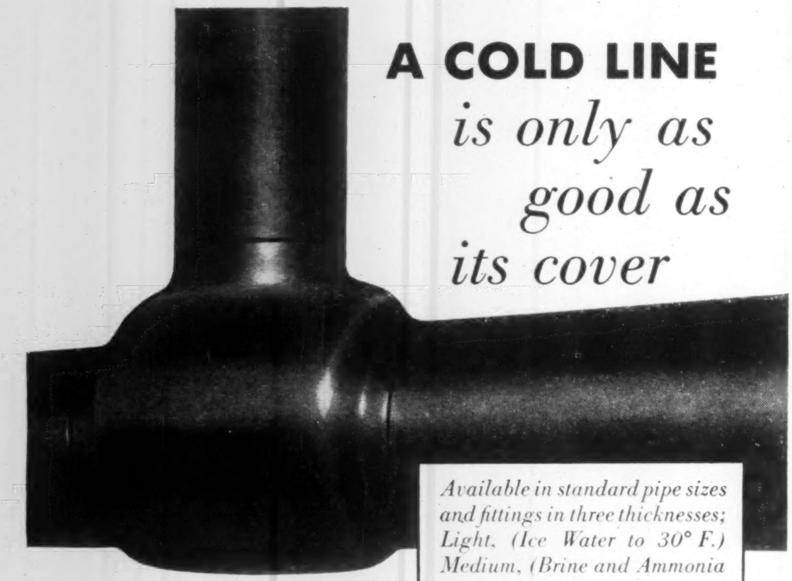
Extra Fast . . .
. . . easy . . . pipe reaming
with this self-feeding
RIDGID
Spiral . . . turns into the work smoothly, no chatter. Famous RIDGID heat-treated cutting edges mean clean reaming, extra long service. Quick enlarging of conduit box outlets—and holes in sheet metal.
More for your money—buy the 2-S at your Supply House.

for power and hand reaming . . .

RIDGID
LonGrip
5 long straight flutes ream clean, easy to control.

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company • Elyria, Ohio • U.S.A.



A COLD LINE
is only as good as its cover

Available in standard pipe sizes and fittings in three thicknesses;
Light, (Ice Water to 30° F.)
Medium, (Brine and Ammonia to 0° F.)
Heavy, (Heavy Brine—25° F. and lower.)

UNITED CORK PIPE COVERING
THE IDEAL COLD LINE INSULATOR

A cold line system is only as effective as its insulation. Inferior pipe covering in just one section of the line will cause operating costs to skyrocket and a considerable loss in dollars to the cold storage operator. United's pipe covering gives you the best insulation with all these advantages:

Extremely low "K" factor
Retains over 80% of cold loss on piping
Easy and economical to install
Long trouble-free life
Fire retardant—Vermin resistant
No capillarity

LARGER STOCKS—FASTER DELIVERY—PERSONAL SERVICE

United Pipe Coverings are available from stock for prompt delivery—to fulfill your immediate installation requirements. Mail the coupon below for additional information or the name of the United distributor nearest you.

Corkboard Pipe Covering Tank Lagging

UNITED BB CORKBOARD

Manufacturers of cork insulation for almost a half century

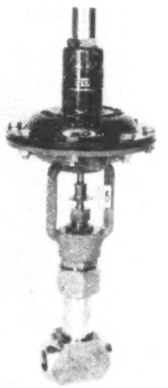
UNITED CORK COMPANIES
1 Central Ave., Kearny, New Jersey

UNITED CORK COMPANIES, 1 Central Ave., Kearny, N.J.
Please send United Cork Catalog. I am interested in
____
NAME ______________________________
FIRM ______________________________
ADDRESS ______________________________
CITY ______________ ZONE ______ STATE ______________

Engineering offices, or approved distributors, in key cities—coast to coast.

EQUIPMENT DEVELOPMENTS

Continued



Bellows Seal Valve . . .

. . . with stainless steel bellows construction totally enclosed in stainless steel barstock housing—*Uniflow Valve Corp., Dept. HPAC, 19 Quine St., Cranford, N. J.*

Three types of bellows available for various pressures to 850 psi. Available in single, double, three-ply. Valves designed with teflon v-ring packing, which is used in conjunction with bellows for double protection in case of bellows failure, says company. Units available in sizes ¼ to 1 in.

Expansion Joints . . .

. . . for power, process piping systems—*Zallea Brothers, Dept. HPAC, 815 Locust St., Wilmington 99, Del.*

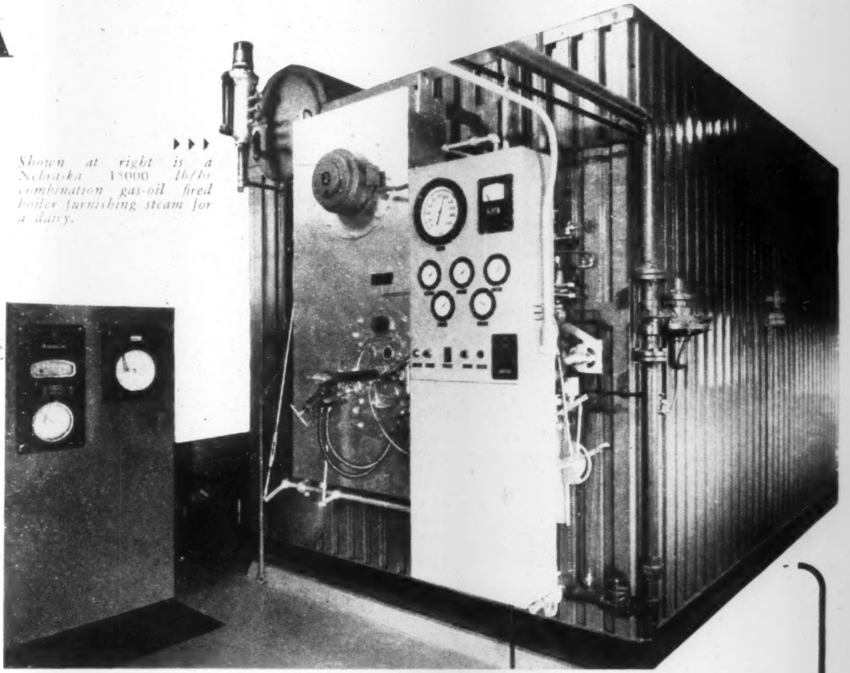
Corrugated, self equalizing units are said to feature longer life, greater high pressure stability. In protecting piping and related equipment against damage due to temperature change, joints employ equalizing rings to distribute pipeline expansion equally to all corrugations, says

BIG WATER TUBE BOILER PERFORMANCE

. . . in a Package Boiler!

NEBRASKA BOILERS are "Made For The Job"

▸▸▸ *Shown at right is a Nebraska 15000 lb/hr combination gas-oil fired boiler furnishing steam for a dairy.*



There are some territories presently open for distributors. Please ask for more details.

When you specify a boiler for any application, you must be sure it will perform safely, economically, reliably, and with your customers complete satisfaction the ultimate goal. You have this assurance when you specify Nebraska Boilers.

Nebraska Boilers will operate year in and year out well beyond the manufacturer's warranty or guarantee with an absolute minimum of attention beyond normal service.

It will pay you to investigate the full Nebraska line . . . drop us a note today for more information.

. . . Check these six points of superiority . . .

1. **A Complete Steam Boiler Package**
   Factory assembled, tested and shipped, from one dependable source.
2. **Fully Automatic Operation**
   Gas, oil, or combination fuels. Forced, or induced draft available.
3. **Sizes to 30,000 lb/hr of Steam**
   18 models with standard design pressures up to 160 psi — higher if necessary.
4. **Dependable Burner, Control Systems**
   Utilizes burners, combustion control equipment, flame failure safeguards etc. with national distribution and service.
5. **ASME Code Construction**
   . . . assures dependability. No moving parts, low heat release rates. Constant reliable steam generation.
6. **Ample Reserve Capacity**
   Quick start-up, fast response to load changes, and economy of operation are built right into every Nebraska Boiler.

Nebraska Boiler Company, Inc., Lincoln, Nebraska

How to stop noise, vibration and "hammer" in water lines

THE ORIGINAL SOUNDZORBER expressly designed for use in air conditioning water lines . . .

SOUNDZORBER

A wire-reinforced wrapped fabric rubber pipe, SOUNDZORBER can be used continuously in water lines at up to 250 psi working pressure (safety factor: 5 to 1).

SOUNDZORBER

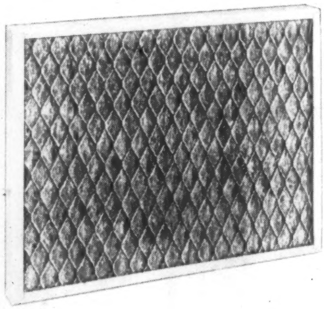
Smaller sizes ½" to 3" available with male I.P.T. bronze fittings. Larger sizes available with integral full-faced rubber flanges backed up with Series 15 or Series 30 steel flanges. No metal-to-metal contact.

SOUNDZORBER

SOUNDZORBER is [illegible] complete line of Finn vibration [illegible] has control devices for every [illegible] problem in your field. Write for [illegible] information.

FINN FINNFLEX VIBRATION CONTROL
INDUSTRIAL DIVISION
T. R. FINN & COMPANY, INC.
200 Central Ave., Hawthorne, N. J.

company. Available in single or double units in sizes 3 to 72 in. diameter. For pressures to 300 psig, temperatures to 1600 F.



Dry Type Filters . . .

. . . for commercial, industrial air cleaning requirements—*Carey Electronic Engineering Co., Dept. HPAC,* 1880 *Clifton Ave., Springfield* 15, *Ohio.*

"A-lum-O-Aire," with aluminum wool media, catches and holds dust, dirt, lint particles without use of oils or adhesives, says company. Filtering done by tiny barbs. Available in standard or specially engineered sizes in ½, 1, 2 in. thicknesses.

Room Air Conditioners . . .

. . . engineered for full cooling capacity, less current, simple installation—*Carrier Corp., Dept. HPAC, Syracuse* 1.

"Super-Crestline" series includes ¾ hp unit requiring 7½ amperes of current, 1 hp model which operates on 115 volt circuits. "Power Cooling" control employs two-step thermostat which "shifts gears" electrically when room temperature approaches desired setting.

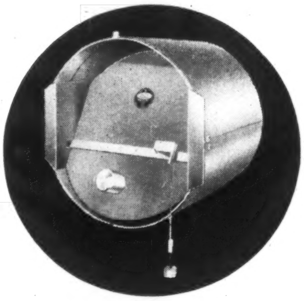
Plastic Construction . . .

. . . material for severe corrosive fume service—*Heil Process Equipment Corp., Dept. HPAC,* 12901 *Elmwood Ave., Cleveland* 11.

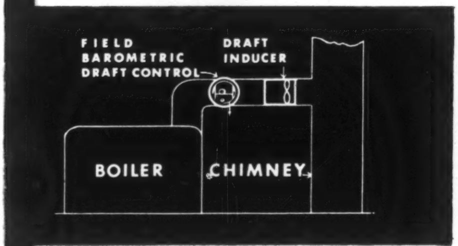
"Rigiply" is glass fiber reinforced laminate of thermosetting resins said to be resistant to wide range of chemicals, including both acids and

FIELD BAROMETRIC DRAFT CONTROLS

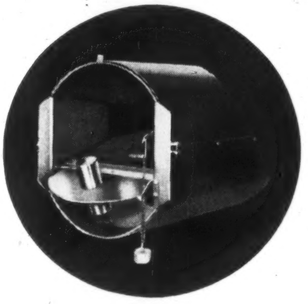
increase the efficiency of induced-draft installations



FIELD TYPE "M" Barometric Draft Control for coal or oil, sizes up to 32".



Field Barometric Draft Control installed in connection with a draft inducer prevents fuel waste caused by wide variations in draft.



FIELD TYPE "MG" Barometric Draft Control for gas or oil-gas, sizes up to 32".

When a draft inducer is used, to assist a faulty chimney, or to permit modern, low-stack construction, a Field Barometric Draft Control should also be installed. In such an installation, the inducer can be set to meet maximum, "high-fire" draft needs without risk of excessive draft. Whenever the draft requirement is less than the draft inducer setting, the Field Control automatically reduces the draft. Here is why the Field Draft Control can make an important contribution to efficiency at all firing rates:

1 - During "off-fire" periods, even the *natural* draft present may be excessive. Field reduces the draft, prevents rapid cooling of the boiler.

2 - During "low-fire" periods, the artificially induced draft may be greater than needed to vent a relatively small volume of gases. Field regulation prevents the loss of high temperature gases.

3 - During "high-fire" periods the Field Control compensates for continuously variable factors effecting draft. For example:

Changes in line voltage, effecting blower speed, change the volume of gases handled and thereby effect the draft.

Changes in resistance caused by the accumulation of fly ash or soot in boiler and breeching cause changes in the draft needed.

Changes in wind and outside temperature, effecting natural draft, cause variations in the artificial draft needed.

Where a number of boilers are discharging into a common stack, the need for draft will vary as firing rates vary. Draft required with all boilers on "high-fire" may be excessive when one or more boilers cut out.

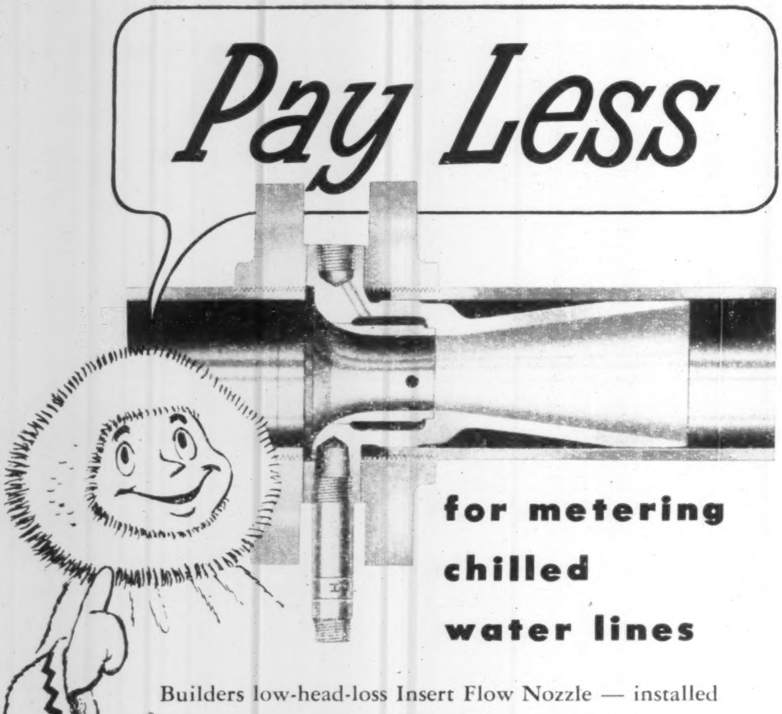
A Field Barometric Draft Control, sensitive to the slightest change in pressure, corrects for any variation, holding draft to the required setting. Write us for technical data. Field Draft Controls are available in sizes up to 32 inches for oil, gas, coal and oil-gas installations.

field

FIELD CONTROL DIVISION
of H. D. Conkey & Company, Mendota, Illinois

AFFILIATES:
Conco Building Products, Inc. • Brick, Tile, Stone — Conco Materials Handling Div. • Cranes, Hoists

Represented in Canada by Ontor Limited, 12 Leswyn Road Toronto 10, Ont., Canada



for metering chilled water lines

Builders low-head-loss Insert Flow Nozzle — installed between flanges in your chilled water lines — assures high-accuracy indication of flow and at the same time keeps meter head loss to a minimum. For air conditioning systems in commercial buildings, shopping centers, and similar multiple-occupant facilities, this hydraulically tested and proven flow nozzle gives the flow facts you need to maintain peak system efficiency.

HERE'S WHY THIS FLOW NOZZLE IS WIDELY ACCEPTED:

Pressure/Temperature Proof: Insert design withstands same pressures and thermal shocks as pipe itself.

±1% ***Enduring Accuracy:*** Precision machining throughout bronze throat liner and contoured inlet. Perpendicularly drilled and reamed piezometer taps.

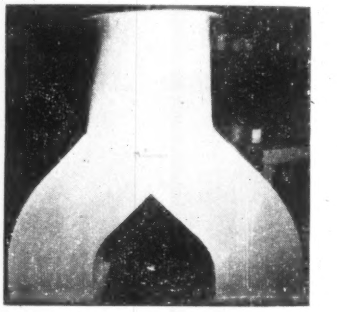
Low Head Loss: Efficient Venturi outlet cone assures high pressure-head recovery — permits use of smaller pumps, motors, piping.

Easy Installation: Pressure taps are built-in . . . no special measurements or machining required in field.

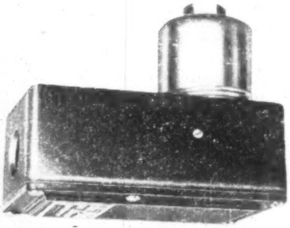
Multiple Throat Vents: For accurate metering even with upstream flow disturbances.

Bulletin 130-K3A gives complete dimension, capacity, and installation data. Write for your copy to **BUILDERS-PROVIDENCE, INC., 381 Harris Ave., Providence 1, R. I.**

BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES
METERS FEEDERS CONTROLS



alkalies. Designed for long service life at minimum maintenance cost. Recommended by company for fabrication of fume exhaust hoods, ducts, stacks, fume scrubbers, tank covers for operations to 250 F.



Pressure Control . . .

. . . added to company's line of standard pressure-vacuum controls—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

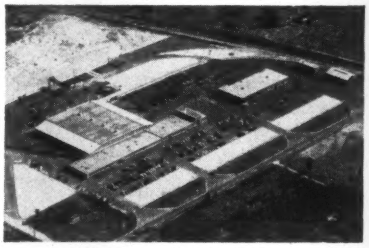
"Type J17A Dual Switch" unit provides two completely separate switch actions, permitting control of two independent circuits and flexibility of switch arrangement, says company. Nine models offered in variety of adjustable ranges between zero and 180 psi limits, and maximum pressures to 180 psi. Available normally open, normally closed, or double throw with no neutral position.

Room Air Conditioners . . .

. . . with higher cooling capacities—*General Electric Co., Dept. HPAC, Appliance Park, Louisville 1.*

Cooling increases for 1957 "Thinline" conditioners range 100 to 650 Btu per hr for different models, says company. Capacity of smallest ½ hp unit raised from 5500 to 5600 Btu

Specify RECO



Tampa Electric Co., Operations Center, Tampa, Fla.
Architect-Engineers:
Stone & Webster Engineering Corp., Boston, Mass.
Reco Representative—W. B. Parson Co., Needham, Mass.

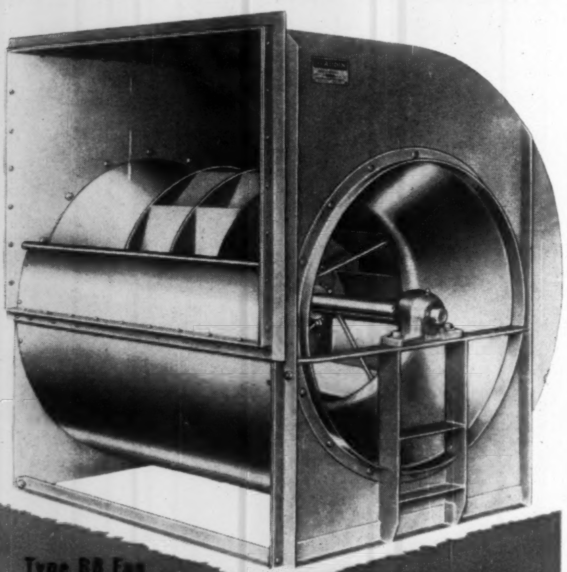
TECO Specifies RECO for hot water at new operations center

Tampa Electric Company's new Operations Center serves Florida's "Center of Activity." And in the center of this huge operations headquarters, a new RECO corrosion-resistant, copper-silicon storage heater serves 2300 gallons of piping hot water per hour. As always, RECO meets round-the-clock demands with minimum maintenance.

Put top quality and performance, fair price and quick delivery into *your* specifications—SPECIFY RECO.

Write today for free catalogs plus name of RECO representative nearest you to:
Dept. N, Richmond Engineering Co., Inc., 7th & Hospital Sts., Richmond 5, Virginia

RICHMOND ENGINEERING CO., INC.



Type BB Fan

Aladdin

AIR HANDLING EQUIPMENT

For EFFICIENCY and QUIET OPERATION...

CERTIFIED PERFORMANCE

CERTIFIED RATINGS

Certified ratings are the result of tests made by the Manufacturer in accordance with the Standard Test Code for Centrifugal, Axial, and Propeller Fans adopted jointly by the National Association of Fan Manufacturers and the American Society of Heating and Ventilating Engineers.

AUTHORIZED BY NAFM

© THE NATIONAL ASSOCIATION OF FAN MFGRS. INC

ALADDIN Type BB Fans are the first choice of many engineers for heating, ventilating and air conditioning jobs. Designed for low rotational speeds and high efficiency, these fans insure that stable performance from free delivery to shutoff that engineers have come to expect of this type of equipment.

In designing the BB Fan, Aladdin engineers have refused to short-cut quality, each fan is ruggedly built and is backed by thirty-five years of experience and manufacturing know-how.

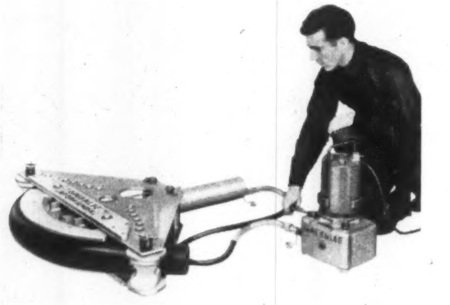
Write for complete data

A1-57

ALADDIN HEATING CORPORATION

1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

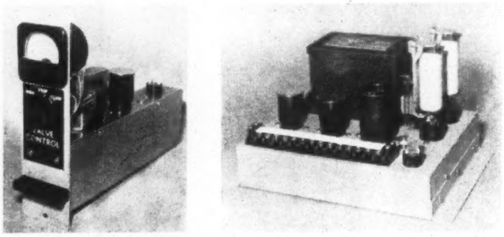
per hr, while capacity of largest 1½ hp unit is boosted from 13,350 to 14,000.



Hydraulic Bender . . .

. . .engineered to make full 90 deg bend in 4 in. and smaller conduit, pipe with one ram stroke—*Greenlee Tool Co., Dept. HPAC, Rockford, Ill.*

Lightweight "No. 884" eliminates costly, time consuming extra setups, says company. Specially designed pipe supports serve as rollers when wheeling unit from one location to another. Can be used in any position without loss of operating efficiency, according to manufacturer.



Position Indicator-Controller . . .

. . .designed to permit remote modulation, continuous indication of valves, similar devices—*Builders-Providence, Inc., Dept. HPAC, 345 Harris Ave., Providence, R.I.*

Accomplished through plug-in transmitter package (left) which has three-position (open, close, off) switch mounted on its face to control device. Receiver (right) contains control relays, regulated d-c voltage supply used to transmit position indication.

Circulating, Coolant Pumps . . .

. . .for sidewall or immersion mounting—*Ingersoll-Rand Co., Dept. HPAC, 11 Broadway, New York 4.*

Units have no stuffing boxes, pump bearings, or couplings, says company. Long shaft construction is said to permit high liquid levels. Sidewall mounted units built in ¾, 1, 1½ in. sizes with single discharge, also ¾, 1¼ in. dual discharge units. Range

Typical KLIXON Built-In Motor Protector for 3-phase motors.

This is the new UNIFIL — a modern, compact, automatic machine, which, Universal Winding Company says, "makes traditional methods of filling preparation startlingly obsolete."

UNIVERSAL WINDING COMPANY

Specifies and Uses KLIXON Protected 3-phase motor in revolutionary new loom winder

In announcing its new UNIFIL® Loom Winder, the Universal Winding Company describes it as "the new concept of filling preparation for the textile industry."

This new machine, which was produced after years of research and development, features a KLIXON protected 3-phase motor.

Universal Winding, like many other manufacturers, now specifies and uses motors with KLIXON Built-In Protectors. They've found that motors which have built-in protection:

- Develop maximum capacity under any overload condition, without danger of burnout.
- Have less production down time.
- Reduce installation costs, repairs, and replacements.

KLIXON protected 3-phase motors are rapidly becoming available in most makes in sizes ranging from fractionals up through 7½ h.p. (600V).

Check with your motor supplier's district office on how to obtain KLIXON protected motors when you place your next order—the additional cost is more than offset by the savings. We'll gladly send literature on request, too—no obligation.

METALS & CONTROLS CORPORATION
Spencer Thermostat Division 3407 Forest Street, Attleboro, Mass.
KLIXON ®

TALL CHIMNEYS ELIMINATED • ON TODAY'S HIGHWAY AND TURNPIKE BUILDINGS

New Jersey Turnpike—
Toll Booths, and Wing Draft
Inducer equipped Administration Building.

WING DRAFT INDUCERS

GIVE CORRECT DRAFT REGARDLESS OF WEATHER • BETTER HEATING • SAVE FUEL

Tally-Ho Motel at Valley Forge, Pa., just off Pennsylvania Turnpike.

One of the several Howard Johnson Restaurants on the New Jersey Turnpike. All are equipped with Wing Draft Inducers.

In motels, restaurants, maintenance and administration buildings on highways and turnpikes across the country Wing Draft Inducers are providing dependable boiler draft, independent of weather conditions. The short stacks for venting the gases are largely hidden and become entirely unobtrusive. Wing Inducers operate automatically, furnish the correct draft for efficiently burning gas, oil, or solid fuels.

Write for Bulletin I-57.

L. J. Wing Mfg. Co. 140 Vreeland Mills Rd., Linden, N. J.

• Wing •
DRAFT INDUCERS

WING REVOLVING HEATERS

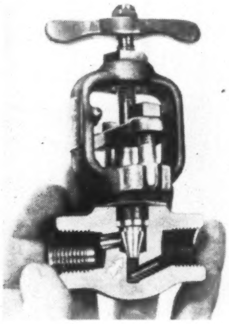
WING FRESH AIR SUPPLY HEATERS

WING TURBINES

WING MOTORIZED BLOWERS

L. J. Wing Mfg. Co., HP-7
140 Vreeland Mills Rd., Linden, N.J.
Please send copy of Draft Inducer Bulletin I-57.
Name
Firm
Address
City Zone State

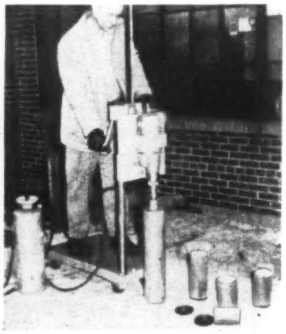
is ¼ to 5 hp with deliveries to 180 gpm at heads to 90 ft. Immersion types built in ¾ to 3 in. discharge sizes with ¼ to 10 hp range and deliveries to 500 gpm at heads to 160 ft.



Valves . . .

. . . designed to combine advantages of carbon steel, stainless steel—*Edward Valves, Inc., Dept. HPAC, East Chicago, Ind.*

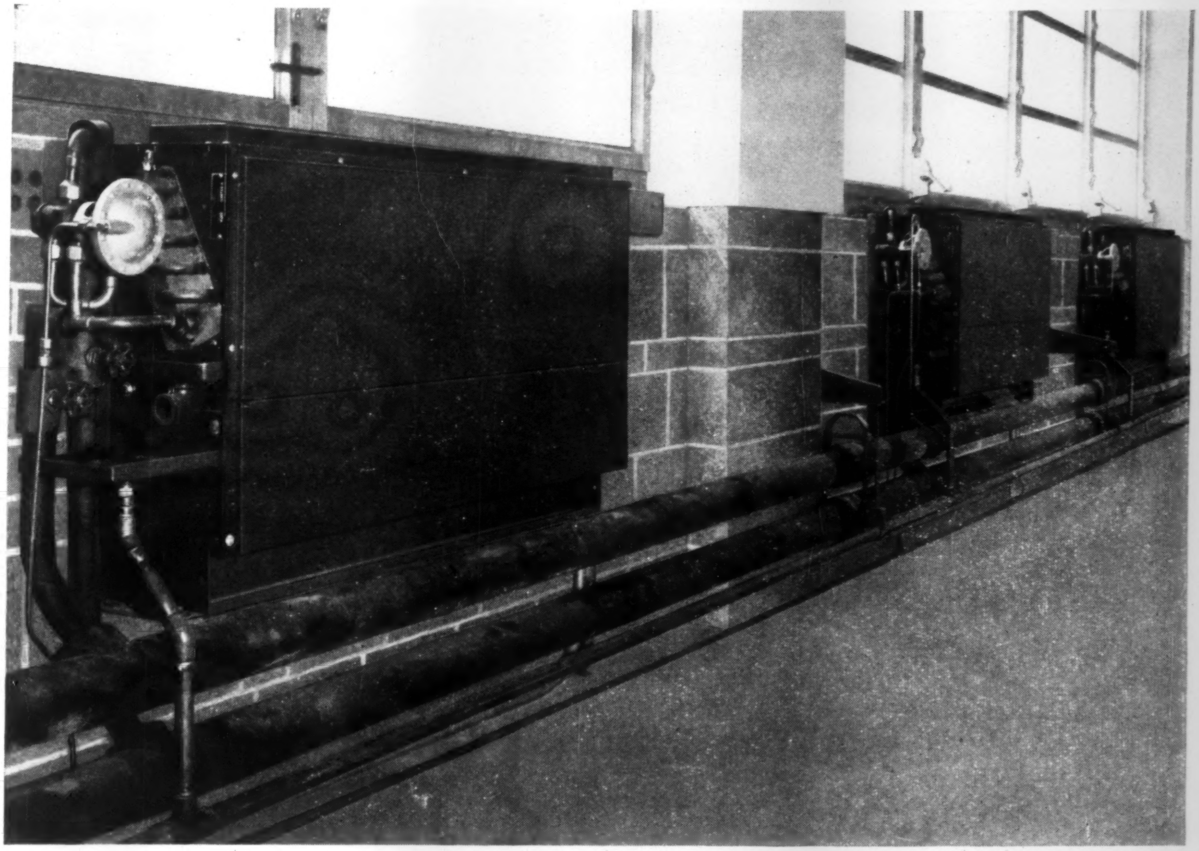
Units are said to have welding advantages of carbon steel, seat wear characteristics equal to stainless steel. Wearing qualities are said to be improved by incorporation of integral seat insert of chrome-cobalt-tungsten alloy. As body of valve is carbon steel, it can be welded into carbon steel pipelines with ease, efficiency, says company. Screwed ends also available. Units rated 2500 lb at 850 F.



Core Drilling Unit . . .

. . . for cutting holes in existing floors or walls for conduit, piping—*Diamond Products, Inc., Dept. HPAC, 402 Prospect St., Elyria, Ohio.*

Using surface-set diamond or dia-



Armaflex is exceptionally flexible for easy application in hard-to-get-at places.

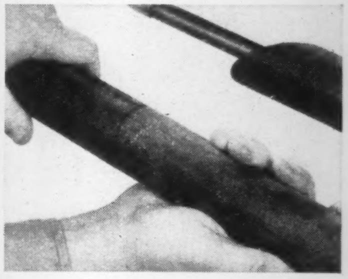
New insulation stops condensation on fluid cooling lines

Armstrong Armaflex®, a flexible foamed plastic insulation, completely seals out air and moisture. A low k-factor of .28 at 75° F. means that Armaflex in ½″ thickness stops condensation on indoor cooling lines operating as low as 32° F. under normal design conditions. This thickness also will prevent condensation on small pipe sizes operating below 32°, within recommended temperature and humidity limits. On larger piping in the lower temperature ranges, double-layer application is recommended.

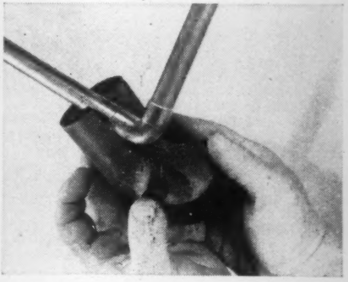
For domestic cold water lines operating above 50° F., Armaflex in ⅜″ thickness may be used. On heating lines, this insulation will withstand temperatures as high as 200° F.

Armaflex is highly flexible for fast, easy application. It comes in 6′ lengths, for pipes and tubing up to 3⅛″ o.d.

Send for free booklet giving complete details on this new insulation. Armstrong Cork Company, 2107 Sherman Street, Lancaster, Pennsylvania.



Easy to install, Armaflex can be slipped right over piping. A talc coating inside the covering speeds application. End joints are sealed with 520 Adhesive.



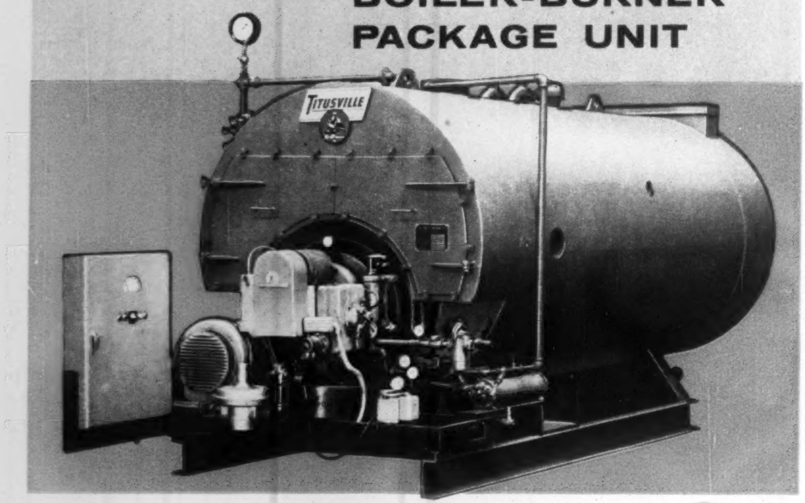
Fast fabrication of fitting covers for copper tubing or iron pipe is easy with miter-cut pieces of Armaflex.

Armstrong INSULATIONS

NOW...THE TITUSVILLE

3pass

BOILER-BURNER
PACKAGE UNIT



WITH 80% PLUS

CERTIFIED EFFICIENCY!

As pioneer and master-builder of Scotch Marine type boilers, TITUSVILLE is proud to present the 3-PASS boiler-burner package unit for high and low pressure and hot water. Offering the highest efficiency obtainable, these new 3-Pass boilers provide economy in service so great as to return the entire investment cost over a few years of operation. Designed for use with any of the leading makes of burners, and for gas, oil, or gas-oil combinations, Titusville 3-Pass boiler-burner units are available in ten sizes, with heating surfaces from 358 to 3571 sq ft. Write for the facts, and a quotation on your requirements.

THE TITUSVILLE IRON WORKS CO.

BOILER DIVISION
BOILERS for Power and Heat . . . High and Low Pressure . . . Water Tube . . . Fire Tube . . . Package Units
PROCESSING EQUIPMENT DIVISION
Crystallizers . . . Direct Fired Heaters . . . Evaporators . . . Heat Exchangers . . . Mixing and Blending Units . . . Quick Opening Doors . . . Special Carbon and Alloy Processing Vessels . . . Synthesis Converters
FORGE DIVISION
Crankshafts . . . Pressure Vessels . . . Hydraulic Cylinders . . . Shafting . . . Straightening and Back-up Rolls
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MACHINERY for Sheet and Structural Metal Forming . . . Tangent Benders . . . Folding Machines . . . Roller Table and Tumble Die Bending Machines . . . Press Brakes . . . Punching and Notching Machines . . . Forming Dies

A Division of

Struthers Wells

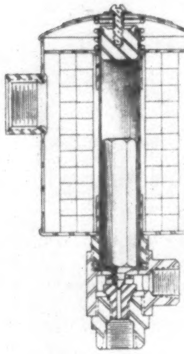
TITUSVILLE, PENNSYLVANIA

Manufacturers of A Complete Line of Boilers for Every Heating and Power Requirement
Plants at Titusville, Pa. and Warren, Pa.
Offices in Principal Cities

EQUIPMENT DEVELOPMENTS

Continued

mond impregnated coring bits. "Hustler" unit drills through cement block at 1' fpm or reinforced concrete aggregate at 5 to 8 min. per ft. Diamond coring bits available in diameters 1/4 to 6 1/2 in. in various grades.



Solenoid Valves . . .

. . . for corrosive gases, liquids—*J. D. Gould Co., Dept. HPAC, 1707 Massachusetts Ave., Indianapolis 18.*

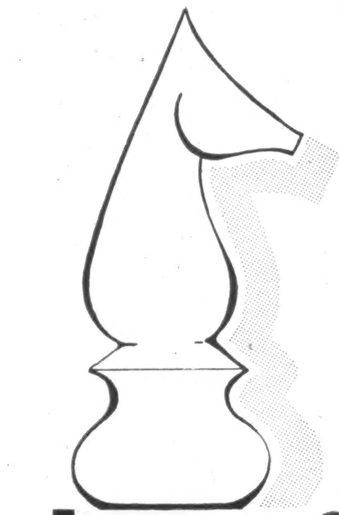
"ALL 316" units available in 1/8, 1/4, 3/8 in. pipe sizes with ports 1/16 to 1/4 in. Cited feature is having only 316 stainless steel and teflon in contact with medium flowing through valve, while maintaining packless feature.

BEAVER
No 2
BEAVER No 2

Pipe Cutter . . .

. . . with "Black Magic" honed edge cutter wheel—*Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

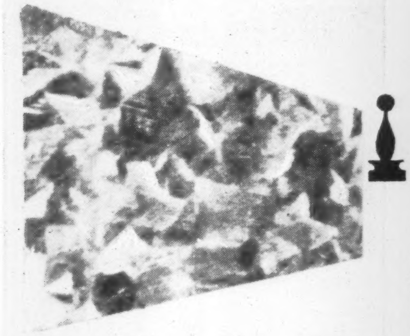
Wheel is also standard on company's "Model-A" and "Speed-O-Matic" pipe machines. Wheel is said to combine easy cutting quality of thin wheel with durability and long life of heavy duty wheel.



YOUR BEST MOVE

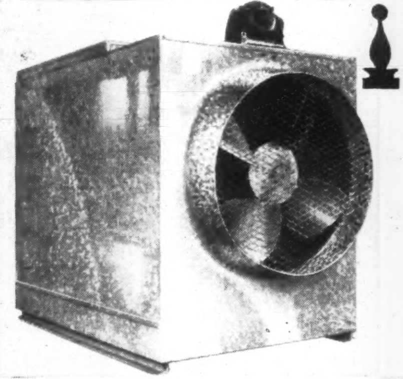
in packaged cooling towers... DOVER

America's New Standard For Packaged Cooling Towers



HOT-DIP GALVANIZING AFTER FABRICATION

. . . effectively stops rust with a heavy zinc coating that leaves no gaps or unprotected spots. You pay nothing extra for the superior protection of hot-dip galvanizing AFTER fabrication.

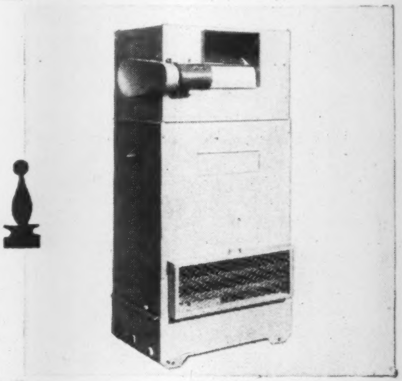


HORIZONTAL INDUCED DRAFT TOWER Series CF

Ruggedly built for efficient operation, it is available in sizes from 2 to 100 tons. The perfect unit for air conditioning and refrigeration installations and for jacket water or compressor cooling.

VERTICAL INDUCED DRAFT TOWER Series V

Has centrifugal blower and is extra quiet in operation. Perfect for installations where space is a problem, it's available in sizes from 5 to 100 tons.

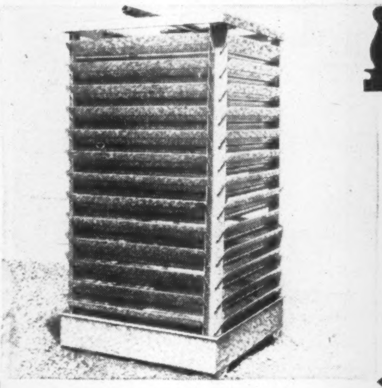


STAINLESS STEEL FANS

All horizontal induced draft towers—Series CF—are equipped with a propeller fan and shaft made of stainless steel. A distinctive Dover feature that insures long life and dependable service.

"TAKE-APART" FEATURE

Unique tie-rod construction, virtually eliminating bolts, enables Dover towers to be quickly disassembled and put together again right on the job site. Difficult locations no longer a problem.

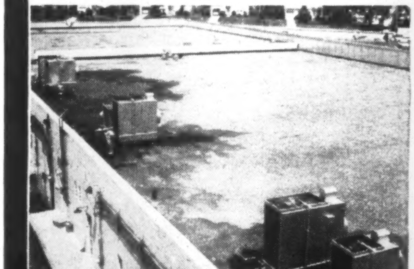


Series K—All steel
Series S—Steel and Redwood

NATURAL DRAFT TOWERS

Both series have famous Dover bolt-free construction, and are available from 2 to 225 tons. Series K meets all municipal fire codes. Series S has steel basins and crowns with redwood louvers and posts; features lower price.

Make your next move now! Send for your free Dover Catalog, displaying their complete line of packaged towers. Act now!



Construction engineers, building the smart, new Mission, Kansas shopping center specified Dover packaged towers. 18 units, ranging from 3 to 100 tons, are now operating efficiently and economically for all the tenants.

DOVER MFG. CO.
Dept. 100, 3117 Weatherford Ave.
Independence, Missouri

☐ **Please send me a free copy of the new Dover Catalog.**

☐ **Please send me the name of my nearest Dover Representative.**

NAME________________________

FIRM________________________

ADDRESS______________________

CITY__________ZONE____STATE____

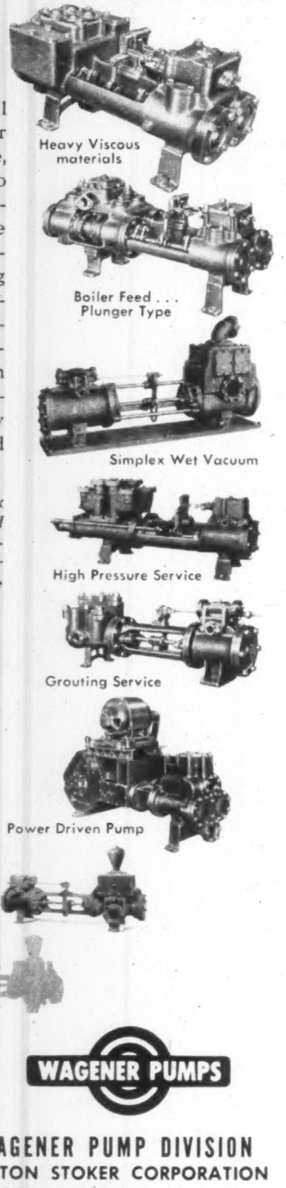
WAGENER PUMPS

FIT JOB REQUIREMENTS

Wagener pumps meet all requirements for power source, capacity, pressure, viscosity and resistance to abrasive and corrosive actions on each job. They are sturdily built for trouble-free pumping. Self-sealing pumcup packing and divided piston rods reduce maintenance costs to the minimum. They are available in price ranges suitable to anticipated usage. Delivery and service are prompt. Send for details . . . today.

Wagener simplex and duplex pumps in both piston and plunger types can be engineered to job specifications for pumping anything that can be pumped:

ACIDS
ALCOHOLS
ASPHALT
BEER MASH
BRINE
BUTANE
CREOSOTE
DYES
GLUE
GROUT
LARD
LIQUOR
MILK
MOLASSES
OILS
PAINT
POTATO MASH
PROTANE
ROSIN
SEWAGE
SOAP
SYRUPS
TAR
TURPENTINE
VACUUM SERVICE
VOLATILE LIQUIDS
WATER
WOOD PULP



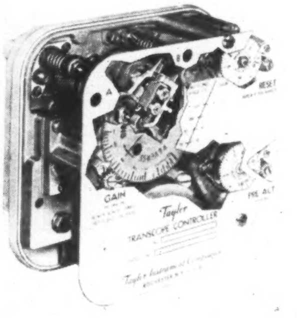
WAGENER PUMPS

WAGENER PUMP DIVISION
CANTON STOKER CORPORATION
2400 Andrew Place, S. W.
Canton 1, Ohio

CANTON STOKERS

N-466-CS

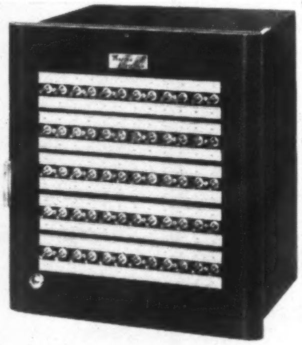
EQUIPMENT DEVELOPMENTS
Continued



Pneumatic Controller . . .

. . . for process applications—*Taylor Instrument Companies, Dept. HPAC, 95 Ames St., Rochester 1, N. Y.*

"Transcope" is said to provide very accurate, compact means for maintaining given set point by relaying measured variables for subsequent corrective action via final control element such as diaphragm valve, lever motor, etc. Uses motion-balance principle through interconnected multiple bellows and springs acting on common force plate.



Selector Switches . . .

. . . for pyrometry circuits—*Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N.J.*

Key type switches designed to provide users with more versatile means of connecting sensing elements to indicators, recorders, other instruments.

Room Air Conditioner . . .

. . . in portable, plug-in model weighing 90 lb—*Whirlpool Corp., Dept. HPAC, St. Joseph, Mich.*

Built-in snow removal called for piping dependability —they used Wrought Iron

Not just snow melting—but *dependable* snow melting—was the leading design objective for this access ramp.

That's why designers of the new Connecticut General Life Insurance Company office building gave such careful consideration to material selection for this access ramp. Four major factors supported the use of wrought iron for this job: its corrosion-resistance—rugged strength—low coefficient of expansion with concrete—ease of fabrication.

In addition to snow melting service, wrought iron pipe was also installed for well water and cold water lines, chilled water mains, and well water piping in the heating and cooling system. Our booklet, "Byers Wrought Iron for Snow Melting Systems," offers case-history support for wrought iron's reliability in this service. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco. International Division: New York, N.Y.

Available in Canada and throughout the world

Connecticut General Life Insurance Company
Office Building: Hartford, Connecticut
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Engineer: Syska & Hennessy, Inc., New York, N.Y.

Contractors: Turner Construction Company, New York, N.Y. (General Contractors)
Cobra Pipe and Coil Company, Elmwood, Conn. (Snow Melting)
C. H. Cronin, Inc., New York, N.Y. (Plumbing)
Kerby Saunders, Inc., New York, N.Y. (Heating and Air Conditioning)

BYERS Wrought Iron Tubular and Hot Rolled Products

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

Four Good Reasons for Specifying

GOODALL
EXPANSION JOINTS

Because they are made of rubber, Goodall Expansion Joints have certain advantages stemming from rubber's natural characteristics. Among these are the following:

1—LONGER SERVICE LIFE. Continuous movement during expansion and contraction actually keeps the rubber joint "alive". There is no deterioration through embrittlement or corrosion.

2—SENSITIVE RESPONSE TO PRESSURE. Only the slightest pressure is required to create movement in the rubber joint, in any direction. Stress on metal pipe or other connected member is therefore reduced to an absolute minimum.

3—EASIER TO INSTALL . . . on new construction or as replacements for other types. Light in weight . . . short face-to-face dimensions . . . retaining rings or flanges quickly aligned and bolted. No gaskets required.

4—AVAILABLE IN "FLANG-LOK" STYLE . . . a patented Goodall development which provides exceptional ease of installation; a far greater sealing face area than the standard right-angle style; and a seal that is completely non-metallic.

* * *

Goodall Rubber Expansion Joints are custom-built to meet specific requirements in sizes from 3/8" I. D. to 96" I. D., for pressures up to 125 lbs. P.S.I. and/or vacuum. They are available in Right Angle and Sleeve Types, as well as "Flang-Lok"; single or multiple arch; tapered; offset; and rectangular.

* * *

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"If it's GOODALL, it MUST be Good!"

Standard of Quality—Since 1870

HOSE · BELTING · FOOTWEAR · CLOTHING
AND OTHER INDUSTRIAL RUBBER PRODUCTS

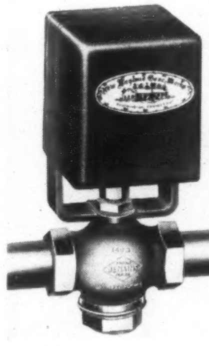
GOODALL Rubber Company

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

EQUIPMENT DEVELOPMENTS

Continued

"Featherweight 75" is easily moved from window to window as comfort dictates, says company. 3/4 hp unit rated 6000 Btu per hr. Operation is on 115 volts with current draw of 7.5 amperes.



Globe Valves . . .

. . . with motorized operation—*New England Gear Works, Dept. HPAC, Meriden Ave. and South End Rd., Southington, Conn.*

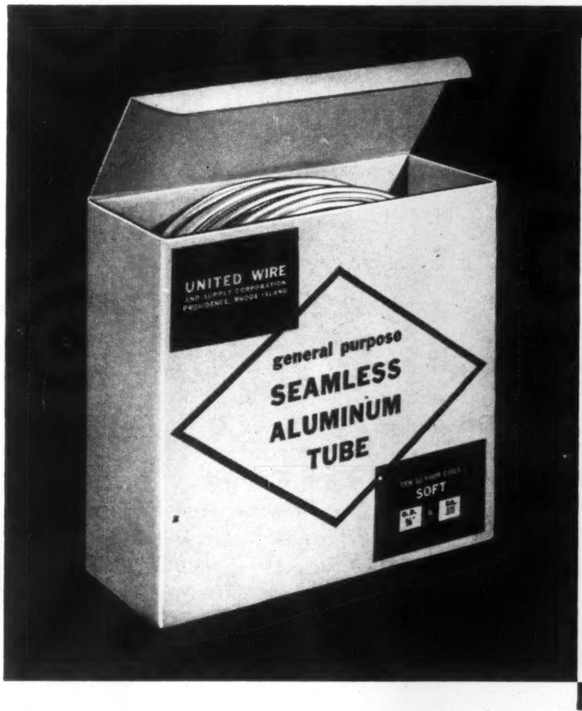
Designed to be simplified, powerful, inexpensive unit. In 10 sizes 1/4 to 3 in. Recommended by company for heating, air conditioning, processing, other applications. Can be controlled by any positive action single-pole, double-throw switch such as temperature, float, manual time, program, or pressure actuated switches, says company.

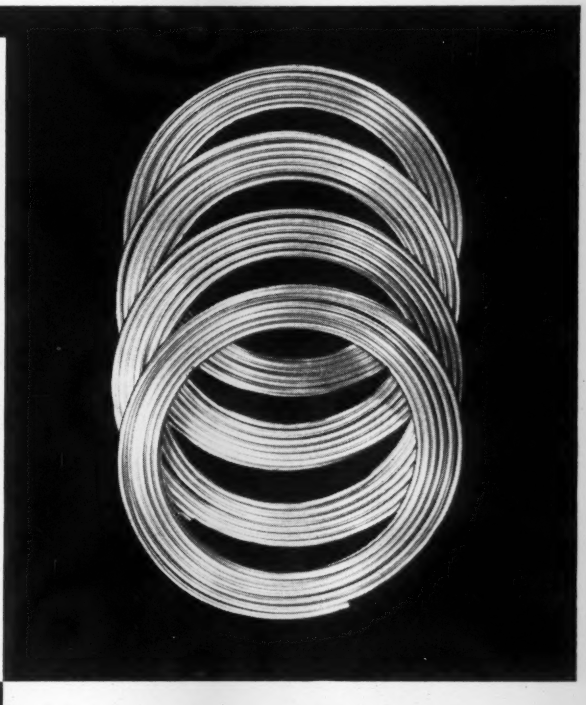
Pipe, Conduit Vise . . .

. . . constructed for "lifetime" of hard use—*Toledo Pipe Threading Machine Co., Dept. HPAC, 1445 Summit St., Toledo 4.*

"No. 22" is said to be built with

Now Available! United's all-purpose seamless aluminum tube





Packaged . . . in Coils

United's All-Purpose Aluminum Tube now comes packaged 10 fifty foot coils to a carton. The famous United "Dulayer" coil is an ideal-space saver, too. It's compact, easy to unwind for cutting or straightening. Available in 12 sizes, 3003-0 alloy, United Aluminum Tube has a uniform soft temper that makes it readily flared; manually or mechanically.

Add to all this United's unique production Quality Control which assures a leak-proof coil (air pressure tested under water) and you have aluminum tube suitable for any coiled tube application.

Tube Size		Capacity Cubic Volume In Cubic Inches Per Ft. of Len.	Safe* Bursting Pressure — In Pounds Per Square Inch
Outside Diameter	Wall Thickness		
⅛	.025	.053	1066
3/16	.028	.161	800
¼	.032	.326	683
5/16	.035	.552	598
⅜	.035	.877	498
⅜	.049	.723	696
7/16	.035	1.269	427
½	.035	1.743	373
½	.049	1.523	521
⅝	.035	2.903	299
⅝	.049	2.618	418
¾	.049	4.007	348

Also available in cut straight lengths from ½" to 20'.

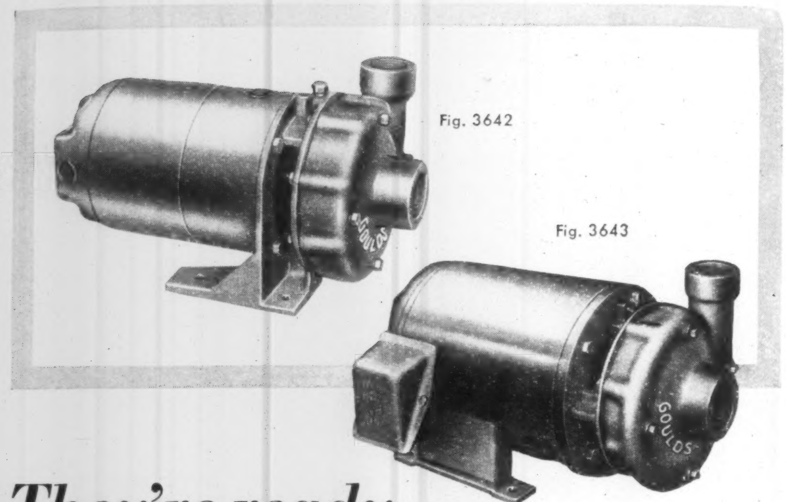
* Based upon a normal Safety Factor of 6. American Standard Code of Pressure Piping. ASA B-31.1-1955

Permanently United

UNITED WIRE
AND SUPPLY CORPORATION

PROVIDENCE 7, RHODE ISLAND

COPPER, BRASS AND ALUMINUM WIRE AND TUBE . . . L. T. BRAZING ALLOYS & FLUXES



They're ready...

in 16 size and motor combinations

Goulds "Close-Cupld" Pumps for air conditioning service

Designed especially for air conditioning systems, these rugged Goulds pumps offer:

Easy installation—Unit assembly. Just bolt it down, locate discharge in any of 8 positions, connect piping and power.

Compact, "close-cupld" construction—Saves space, and assures permanent alignment of rotating parts.

Mechanical seal—Doesn't leak, or bind the shaft, or run dry, or need adjustment or maintenance.

Quiet operation—Balanced, vibration-free impeller is only moving part driven by ball bearing motor.

These pumps are available in the sizes shown below—in all iron, bronze-fitted, or all bronze construction. Maximum temperature 212° F. Maximum working pressure 100 lbs. Full details and dimensions in Bulletin 624 A-3.

GOULDS "CLOSE-CUPLD" PUMPS FOR AIR CONDITIONING SERVICE

	Size	Motors	Capacity (GPM)	Head (Feet)
Fig. 3642	1″	¼ to 1½ HP	32 to 58	38 to 118
	1¼″	½ to 2 HP	70 to 110	36 to 102
Fig. 3643	1½″	3 or 5 HP	142 to 182	103 to 142
	2½″	3, 5, or 7½ HP	250 to 370	72 to 138

GOULDS

PUMPS FOR AIR CONDITIONING

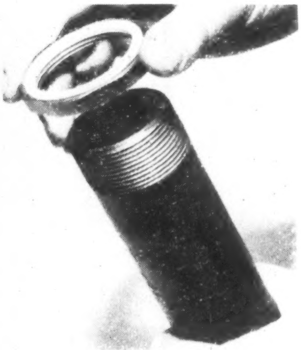
GOULDS PUMPS, INC.
Seneca Falls, N. Y., Main Office and Works
Branches
ATLANTA, 15 Peachtree Place, N.W.
BOSTON, Room 314, 1330 Beacon St. Brookline, Mass.
CHICAGO, 53 West Jackson Blvd.
HOUSTON, 2314 Main St.
NEW YORK CITY, Room 1503, 11 Park Place
PHILADELPHIA, 2099 North 63rd St.
PITTSBURGH, Room 512 Bessemer Bldg., 140 - 6th St.
TULSA, 543 East Apache St., P. O. Box 6157

West Coast Representative: GOULDS PUMPS Western, Inc., 1919 N.W. Thurman St., Portland 9, Oregon
In Canada: The A. R. Williams Machinery Co., Ltd.... in all principal cities

EQUIPMENT DEVELOPMENTS

Continued

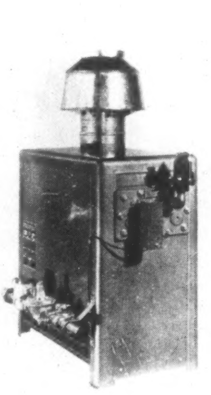
strong, sturdy frame with large diameter acme screw thread connected directly to upper jaw for longer service. Vise yoke mounts quickly for right or left hand use, says company. Interchangeable jaws designed for maximum grip regardless of pipe or conduit size.



Pipe Fitting . . .

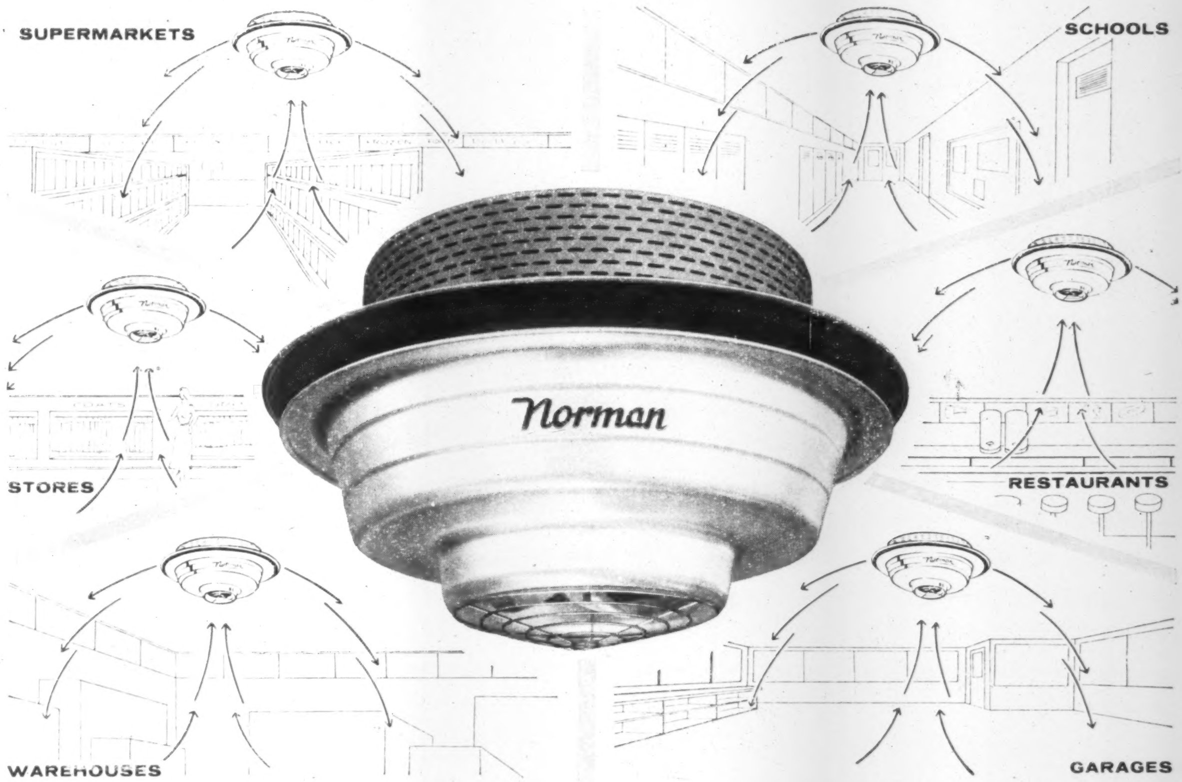
. . . for preventing refrigerant leaks at pipe connections—*Flick-Reedy Corp., Dept. HPAC, 2040 N. Hawthorne Ave., Melrose Park, Ill.*

For use in such locations as compressor inlets and outlets, expansion valves. Can be screwed on all standard pipe threads like ordinary nut, and does not need sealing compounds, says company. For pressures to 10,000 psi, temperatures —200 to 500 F.



Water Heaters . . .

. . . designed to give long service despite severe operating conditions, high volume requirements—*Laars Engineers, Dept. HPAC, 13246 Saticoy St., North Hollywood, Calif.*



Beautiful Answer to 101 Overhead Heating Jobs

Norman Three-Sixty ®

FORCED CONVECTION OVERHEAD GAS HEATER

You'll like the way prospects like the ultra-modern Norman Three-Sixty, and you'll appreciate its exclusive features that give you such a profitable edge on competition.

Here's how the Norman Three-Sixty assures constant air circulation without stratification. An intake fan draws air from the floor up into the bottom of the unit where the air is heated and distributed outward and slightly downward in a full 360° radius to form an umbrella of comfortable warmth.

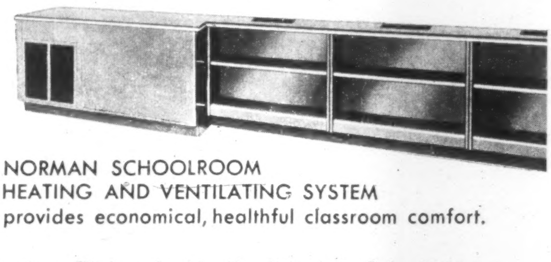
- **Sealed Combustion System**
- **Exclusive Electric Ignition**
- **Forced Exhaust**
- **100% Outside Air For Combustion**

The exclusive sealed combustion system with electric ignition lets you install the Three-Sixty where ordinary unit heaters can't go. The system also permits efficient and economical installation in multi-story buildings.

Find out why the Norman Three-Sixty offers you so much more in opportunity for increased sales and profits.

Send the coupon today for literature and details.

Norman® products company



NORMAN SCHOOLROOM
HEATING AND VENTILATING SYSTEM
provides economical, healthful classroom comfort.

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1156 Chesapeake Ave., Columbus 12, Ohio

Rush literature and details on the Norman Three-Sixty Forced Convection Overhead Gas Heater and other quality Norman gas-fired heating equipment.

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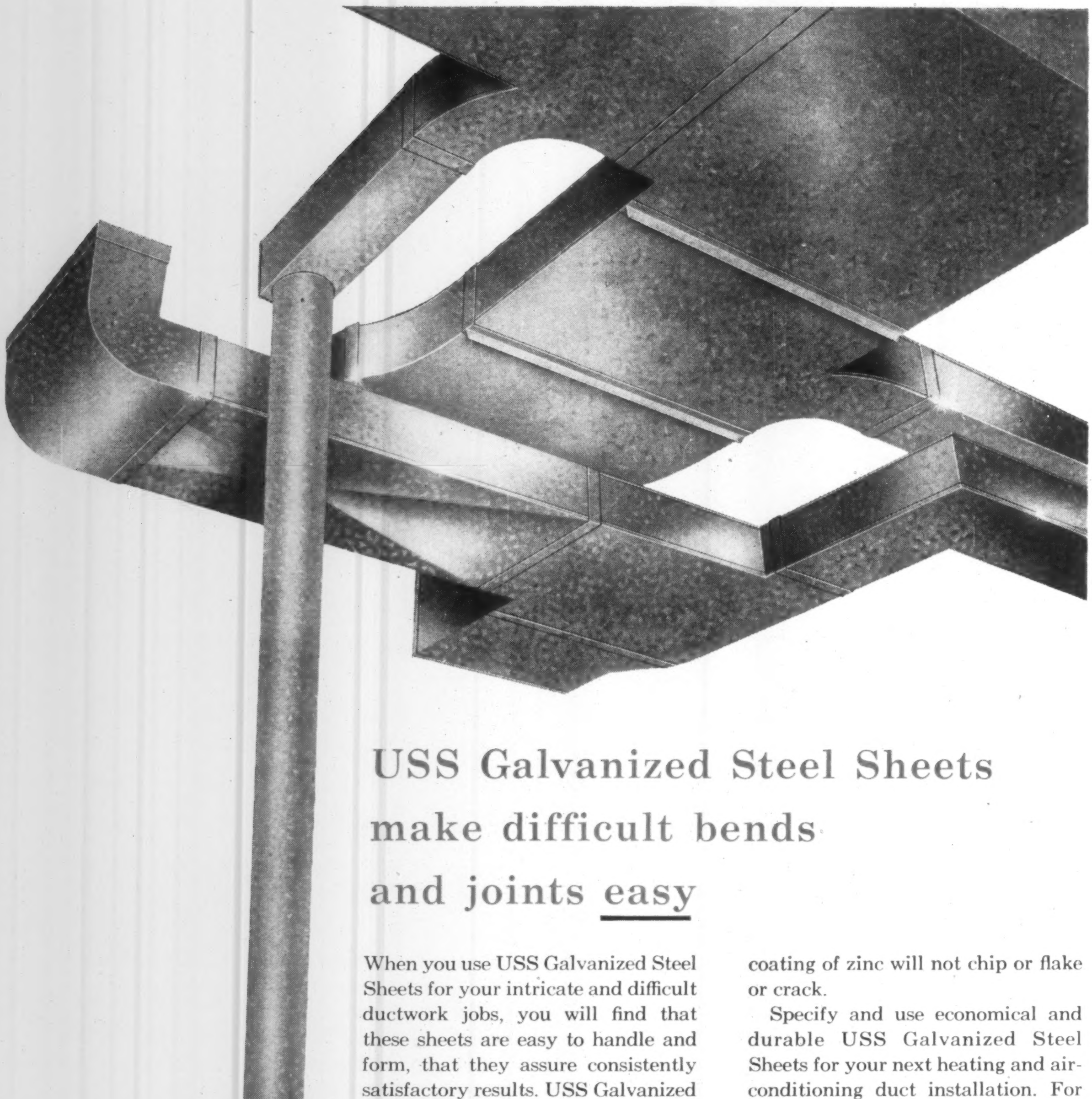

USS Galvanized Steel Sheets make difficult bends and joints easy

When you use USS Galvanized Steel Sheets for your intricate and difficult ductwork jobs, you will find that these sheets are easy to handle and form, that they assure consistently satisfactory results. USS Galvanized Steel Sheets are uniform in flatness, ductility and finish. They can be cut, bent, soldered, lock seamed and rolled . . . and the tightly-adhering coating of zinc will not chip or flake or crack.

Specify and use economical and durable USS Galvanized Steel Sheets for your next heating and air-conditioning duct installation. For more information on these fine, quality galvanized steel sheets, get in touch with the nearest Sales Office of United States Steel.

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UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

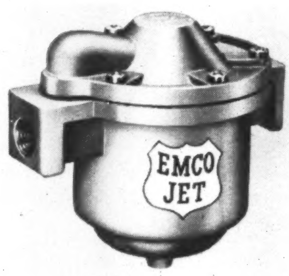
USS

UNITED STATES STEEL

EQUIPMENT DEVELOPMENTS

Continued

For restaurants, industrial plants, hotels, motels, apartment houses, schools, similar applications. Cited feature is heat transfer section, which contains no coils nor concealed water passages. Burns natural, manufactured, LP gases. In 17 models with inputs 103,000 to 2,800,000 Btu.



Compressed Air Filter . . .

. . . designed to automatically eliminate moisture, sludge, other foreign substances heavier than air from entering air operated devices—*Emco Pneumatic Corp., Dept. HPAC, 1317 Locust St., Des Moines, Iowa.*

"Emco Jet" ½ in. unit operates on maximum of 90 cfm. Maximum working pressure is 600 lb. Engineered to filter air for pneumatic equipment operating on intermittent air flow.

Industrial Stethoscope . . .

. . . designed to permit listening-in on internal, external sounds of running machines—*M. Paquet & Co., Inc., Dept. HPAC, 17 Battery Place, New York 4.*

"Airsonic" tells listener where malfunction, defect, or excessive wear is in machine that is not functioning properly, says company.

Control Unit . . .

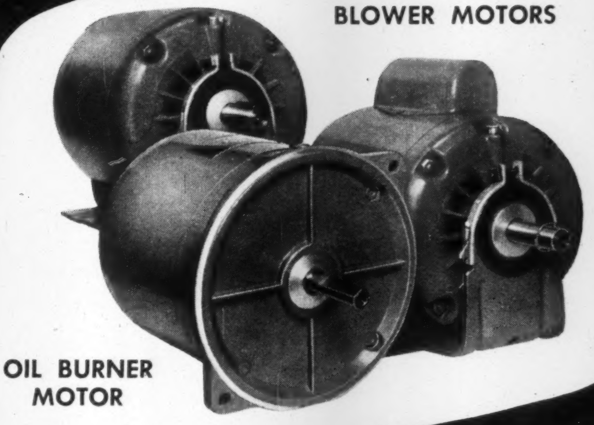
. . . for controlling difference in pressure between two pressure or vacuum sources—*United Electric Controls Co., Dept. HPAC, 79 School St., Watertown 72, Mass.*

Each switch has separate uncalibrated adjustment screw. Switches become actuated when pressure on

MARATHON ME ELECTRIC

HEATING
AIR CONDITIONING
MOTORS

BLOWER MOTORS



OIL BURNER
MOTOR

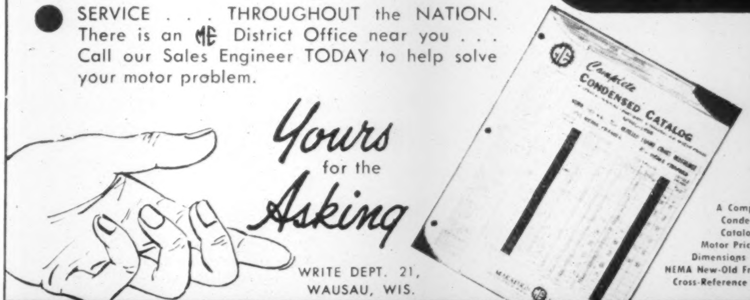
A COMPLETE LINE OF EXPLOSION PROOF MOTORS AVAILABLE ALL CARRY THE LABEL

FOR
UNIT HEATERS ....OIL BURNERS
BLOWERS ....COMPRESSORS
VENTILATORS ....PUMPS
COOLING TOWERS........................ etc.

- ● EXPERIENCE . . . PROVEN PERFORMANCE. There is no substitute for the reliability of proven performance . . . Top Names of the Nation's Industry have proven ME performance in PRODUCING QUALITY PRODUCTS.
- ● VERSATILITY . . . WIDE RANGE OF DESIGN. Single Phase . . . Polyphase . . . Direct Current NEMA Standard . . . or Special Design ME can design to meet your special specifications.
- ● SERVICE . . . THROUGHOUT the NATION. There is an ME District Office near you . . . Call our Sales Engineer TODAY to help solve your motor problem.

MOTORS
1/20 HP thru
2500 HP

GENERATORS
1/2 KW thru
2000 KW



Yours for the Asking

WRITE DEPT. 21,
WAUSAU, WIS.

A Complete Condensed Catalog of Motor Prices & Dimensions with NEMA New-Old Frame Cross-Reference List

SINCE 1913

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HOME OFFICE AND FACTORY, WAUSAU, WIS. FACTORIES AT ERIE, PA. AND EARLVILLE, ILL.

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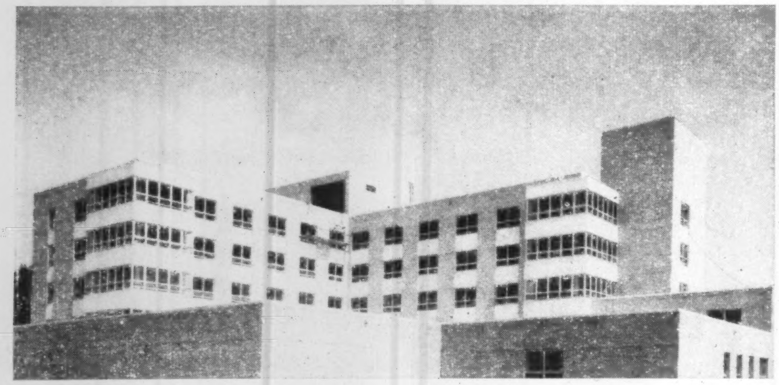
SAVES $50,300...



Savannah Memorial Hospital cuts air conditioning load 74 tons with KoolShade

...100%-fresh-air cooling made economically feasible.

Of the many features of Memorial Hospital, Savannah, Ga., none is more outstanding than its unusual air conditioning. It is primarily a 100%-fresh-air system!

Clearly superior to recirculating systems, 100%-fresh-air cooling has one problem: it requires far greater refrigeration tonnage. Hence it was economically imperative that Memorial seek out every practical means of reducing the load.

KoolShade Sunscreen — applied on south, east and west windows — was chosen immediately . . . and no wonder!

By controlling the solar heat transmission through glass, KoolShade actually reduced tonnage requirements by 74 tons! (Comparison: 2 inches of wall insulation was "worth" 72 tons.) Dollar savings, over and above the installed cost of the Koolshade, amounted to an estimated $50,300! And of course the building will continue to benefit from the lowered operation and maintenance costs.

Thus another great building proves it pays to *investigate* KoolShade Sunscreen!

Only Koolshade Sunscreen offers

- **unsurpassed shading efficiency** — keeps up to 87% of the sun's rays off windows during the hottest parts of the day: frees air conditioning systems from "hot spot" over-loads, gives relief from heat and glare, protects furnishings from sun-fading.
- **84% clear visibility** — better than with ordinary insect screening.
- **harmony with all architecture**
- **excellent insect protection** — no other screens needed on open windows.
- **virtually no maintenance** — strong metal fabric fully weatherized . . . never needs paint . . . lasts for years . . . withstands hard blows.

Send today for this detailed and illustrated bulletin. And for expert help in cutting costs and sun problems, just request a call from a KoolShade engineer. No obligation or charge.

Distributor franchises still open in many communities for those who qualify.

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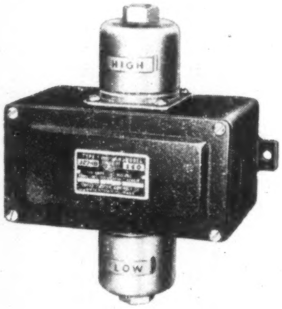
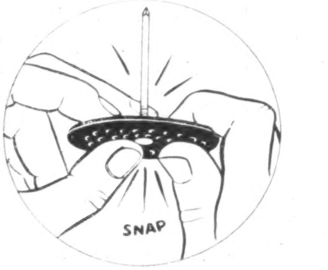


high side exceeds pressure on low side by preset amounts, regardless of static pressure value, says company. May be set together to simulate double-pole circuitry or set apart to obtain independent operation. Seven models offered with various system differentials to 90 psi. On-off switch differentials between limits of 1 in. Hg and 5 psi obtainable.



Insulation Hanger . . .

. . .consisting of nylon base plate 1⅝ in. in diameter, metal spindle in four lengths from 1⅝ to 8½ in.—*Goodloe E. Moore, Inc., Dept. HPAC, Danville, Ill.*

"Tuff-Weld" spindles are pushed through base plates, snapped into place just before two-piece units are to be attached to duct with adhesive.

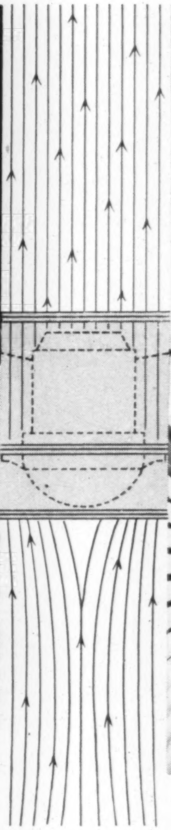
Manometers . . .

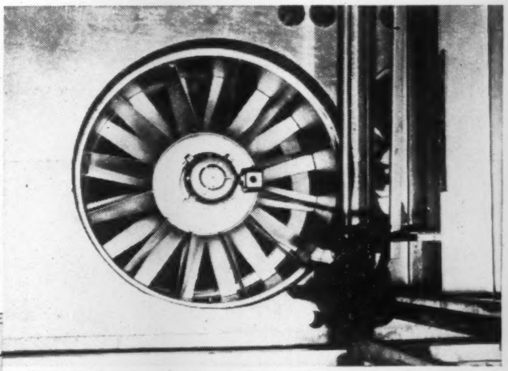
. . .for general use as light pressure and vacuum indicators—*F. W. Dwyer Mfg. Co., Dept. HPAC, P.O. Box 373, Michigan City, Ind.*

"Series 1225" unit recommended by company for determining velocity and static pressures, leakage, fan and blower efficiency, resistance through filters, gas pressure, other measure-

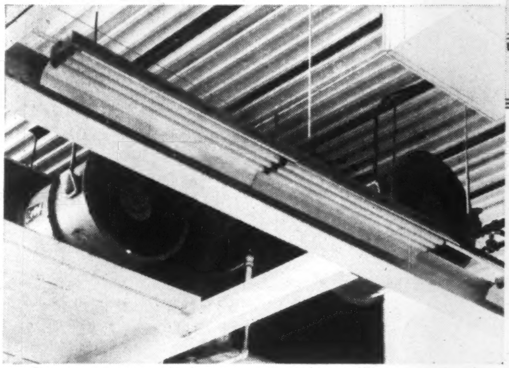
Ventilation Problems: Gone with the Joy Axivane Wind

Compact Joy installation at Boqueron, Venezuela, moves huge quantities of air.

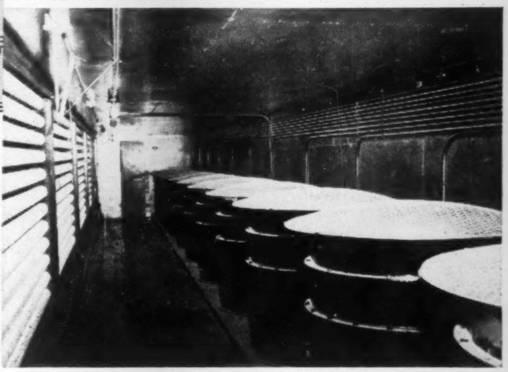




Joy Axivane design means power savings at Alcoa's Texas Plant.



Space-saving Joy fans are installed as part of the duct system at Reliance Electric's Ohio Plant.



Dependable Joy installation circulates freezing air in California Cold Storage Plant.

'Round the World, JOY Handles the Hard Ventilating Jobs

If you have a really tough ventilating job coming up . . . moving large volumes of air . . . variable pressures and volumes . . . unpredictable resistance . . . cramped space allotment . . . better take a look at the Joy Axivane Fan.

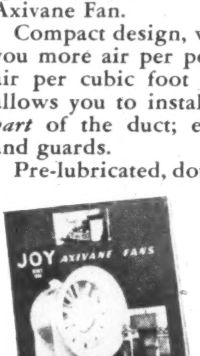
Compact design, with the motor *inside* the fan gives you more air per pound of fan and motor . . . more air per cubic foot of fan. The straight-thru design allows you to install it right *in* the duct; becomes a *part* of the duct; eliminates offsets, elbows, drives and guards.

Pre-lubricated, double-shielded ball bearings permit the fan to be installed in *any* position. Adjustable blades allow for unpredictable resistance . . . permit changes in volume or pressure, *after* the fan is installed.

You choose from a standard line of over 136 models . . . and still have the advantage of Joy's custom engineering service. Joy Axivane Fans can make your next ventilating job a lot easier . . . that's one reason why Joy gets the tough assignments.

Get complete information about Joy Axivane Fans from ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.

WSW 15840-17



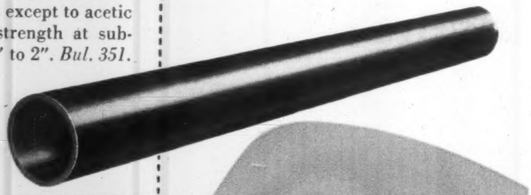
WRITE FOR FREE BULLETIN 17-41

JOY . . . EQUIPMENT FOR INDUSTRIAL PLANTS . . . FOR ALL INDUSTRY

STATIONARY AIR and GAS COMPRESSORS • NON-LUBRICATED COMPRESSORS • BOOSTER COMPRESSORS • VACUUM PUMPS • PORTABLE COMPRESSORS • INDUSTRIAL FANS • PORTABLE BLOWERS • FOUNDATION BREAKERS • HOISTS • ELECTRICAL PLUGS, RECEPTACLES and POWER DISTRIBUTION SYSTEMS

STAYS TOUGH
AT SUB-ZERO TEMPERATURES

ACE PARIAN . . . odorless, tasteless, rigid polyethylene. Best chemical resistance of any plastic at room temp. except to acetic acid. Excellent impact strength at sub-zero temp. Rigid pipe ½" to 2". *Bul. 351.*



"SUPPLEX" POLYETHYLENE 1 INCH 75 PSI
SUPPLEX' POLYETHYLENE 1 INCH 75 PSI NSF APPROVED
SUPPLEX' POLYETHYLENE

SUPPLEX . . .

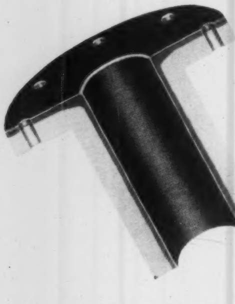
Money-saving flexible pipe for water lines

Supplex is non-toxic flexible polyethylene pipe, ideal for water distribution lines, drain lines, jet wells, etc. Excellent chemical resistance. Need only screwdriver and knife to install, using Ace insert type fittings. Approved by National Sanitation Foundation for drinking water. Sizes ½" to 2". *Bulletin CE-57.*

Now eleven ACE Materials to

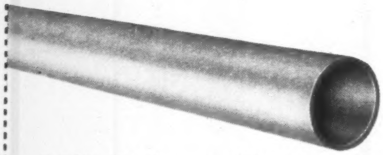
STOP CORROSION

Eleven job-proved rubber and plastics materials now available in ACE piping, valves, pumps and tanks. Tough Ace-lte rubber-plastic blend . . . Saran . . . heat-resistant Tempron . . . Riviclor PVC . . . many others. Write for comparative properties Bulletin CE-50 . . . or call your American Hard Rubber Co. distributor.



FOR HIGH PRESSURES
OR BIG PIPE LINES

ACE Rubber-Lined Steel . . . strength and pressures of steel plus chemical resistance of hard rubber. Excellent for alkalis, most inorganic acids, many organic acids, all salts, bleaches. Sizes 1¼" to 24" and up. *Bulletin CE-52.*



RIGID VINYL . . . STRONG,
AGE-PROOF

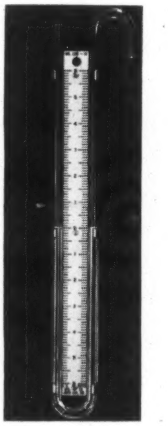
ACE RIVICLOR is a new rigid threaded plastic pipe with good aging and high impact strength. Not affected by most inorganic acids and alkalis, also excellent for many organics. Sizes ½" to 4". *Ask for Bulletin CE-56.*

ACE processing equipment of rubber and plastics

AMERICAN HARD RUBBER COMPANY
93 WORTH STREET • NEW YORK 13, N. Y.

EQUIPMENT DEVELOPMENTS

Continued

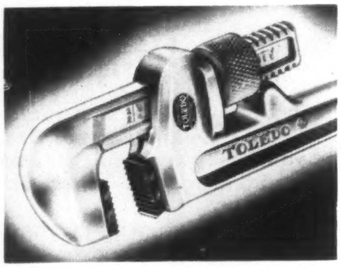


ments. Available in 6, 12, 18 in. sizes with either straight or inverted "U" connections for rubber tubing at top.

Pool Heaters . . .

. . . with "ultra sensitive" thermostat —*Laars Engineers, Dept. HPAC, 13246 Saticoy St., North Hollywood, Calif.*

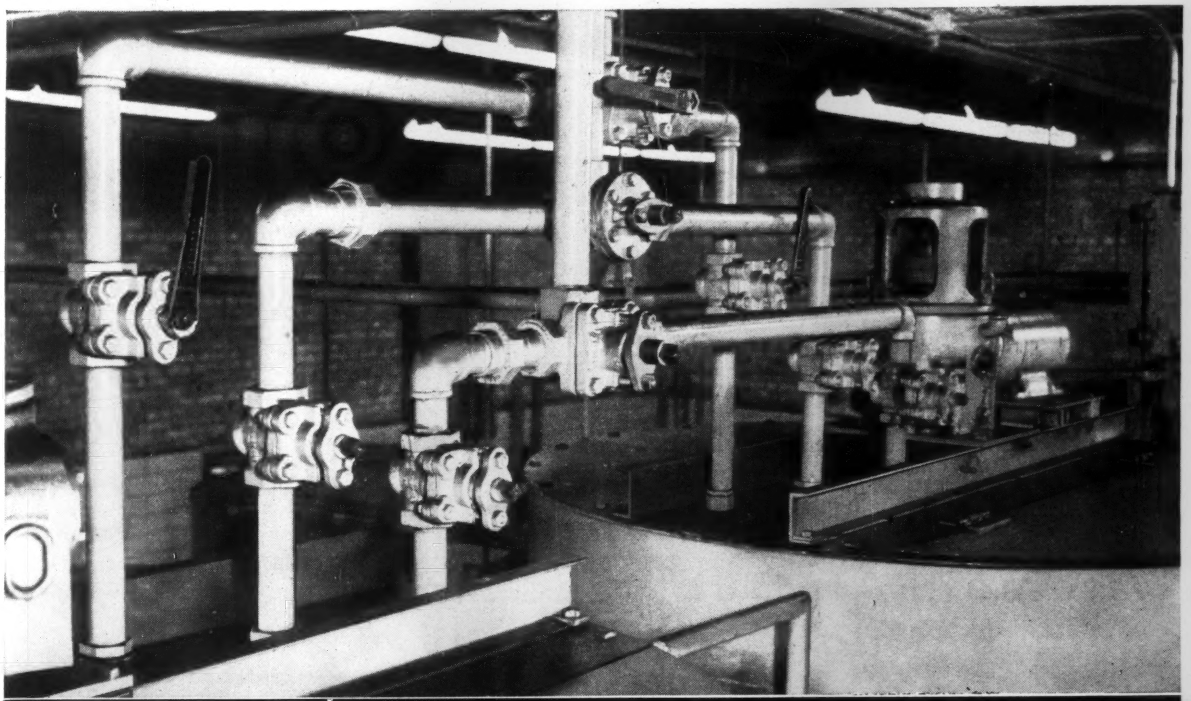
Designed to maintain swimming pool temperature within 1/10 F deg., device allows heater to operate only long enough to regain loss, says company.



Aluminum Wrenches . . .

. . . in 10, 14, 18, 24, 36 in. sizes—*Toledo Pipe Threading Machine Co., Dept. HPAC, 1445 Summit St., Toledo 4.*

Units feature aluminum handle, housing and hook with replaceable forged steel insert jaws and forged heavy duty nut on sizes 10, 14, 18 in.; choice of forged aluminum housing and handle, forged aluminum hook with forged steel replaceable jaw inserts or forged steel hook on 24, 36 in. sizes, says company.



Aqueous and Lacquer-Type Coatings . . . Duplicating Inks . . . Condensate . . . Hot Water are handled by

HOMESTEAD *Cam-Seald*

PLUG VALVES

AT A. B. DICK COMPANY, CHICAGO

Positive, drop-tight seal without lubrication . . . quick operation; only a quarter-turn to open or close . . . sealed bottom, and stuffing box that prevent leakage . . . seating surfaces that are protected in both the open and closed positions for extra long life—these are some of many features that influenced the choice of Homestead Cam-Seald Valves for this modern plant. The more than 5,000 Homestead Valves of various types, in service at A. B. Dick Company's Chicago, Illinois Plant were chosen only after an analysis of numerous types of valves showed that "HOMESTEAD'S" were well suited for the service conditions.

You can prove to your own satisfaction that HOMESTEAD PLUG VALVES give long, dependable drop-tight service with low upkeep, by installing a few in your plant. Full particulars are yours without obligation.

MAIL THE COUPON TODAY

2½
HOMESTEAD
200

**Please mail, without obligation,
Valve Reference Book
No. 39—Section 2.**

Name___________________________Title___________

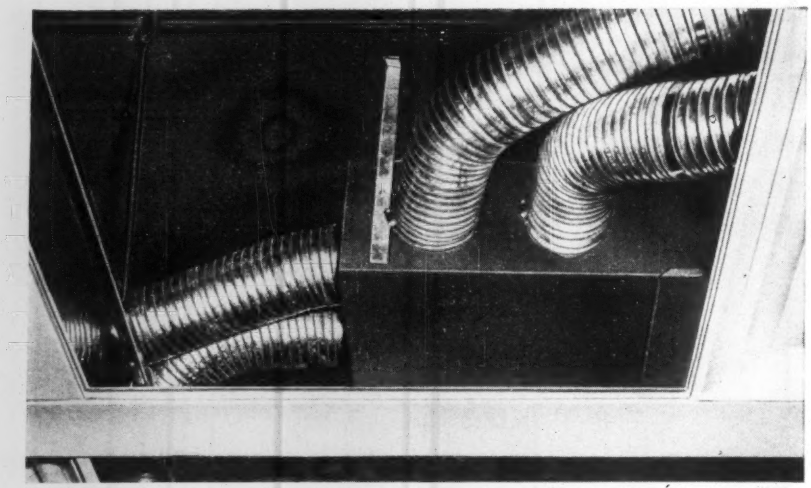
Company______________________________________

Address_______________________________________

City____________________________State___________

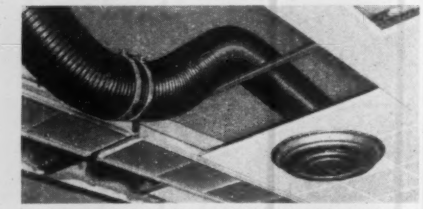
HOMESTEAD VALVE MANUFACTURING COMPANY

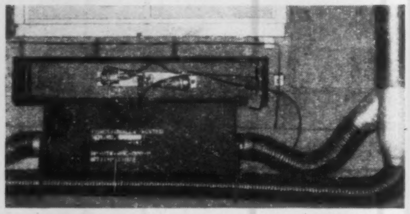
P. O. BOX 128 *"Serving Since 1892"* CORAOPOLIS, PA.

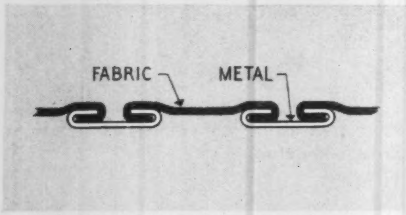

Socony Mobil Bldg., N. Y. C. — Wiremold Air Duct "octopus" in a high-velocity air conditioning system.

CEILING LIMITED?

Wiremold Air Duct leads in and out of tight spots easily


Indiana Nat'l. Bank Bldg., Indianapolis—Wiremold Air Duct runout from branch duct to ceiling diffuser.


Cuyahoga County Bldg., Cleveland—Wiremold Air Duct connects hot and cold risers to underwindow units.



Exclusive construction—fabric component and supporting steel spiral are mechanically interlocked.

The path from attenuation box to ceiling outlet is often full of obstacles. But Wiremold Air Duct just sweeps around them, making it ideal for air conditioning installations — both low and high velocity.

Made by an exclusive process that mechanically interlocks the fabric with the supporting steel spiral, there is no glue to dry out and cause duct failure. As a result, Wiremold Air Duct provides long life and good performance. Its light weight makes it easy to handle — especially important in cramped quarters.

other advantages

- good air flow with minimum pressure loss
- no air leakage at normal operating pressure
- meets National Board of Fire Underwriters requirements
- compensates for misalignments between connections
- allows for future relocation of units
- acts as a vibration damper
- easy to cut, fit and install

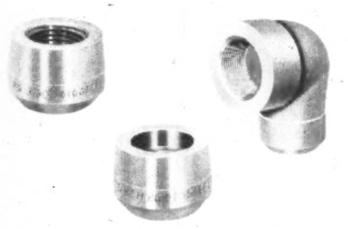
SEND FOR FOLDER NO. 591 for further information on Wiremold Air Duct.

WIREMOLD® FLEXIBLE AIR DUCT

THE WIREMOLD COMPANY, HARTFORD 10, CONNECTICUT

EQUIPMENT DEVELOPMENTS

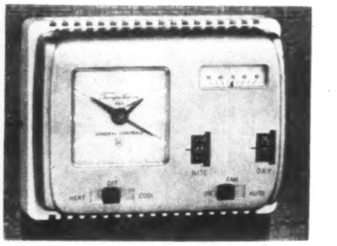
Continued



Branch Outlet . . .

. . . connections for pipelines, tanks, pressure vessels—*W-S Fittings Div., H. K. Porter Co., Inc., Dept. HPAC, P.O. Box 95, Roselle, N.J.*

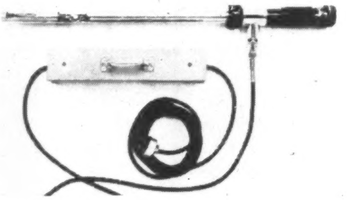
"Couplets" designed to function as universal outlet connections. Are said to be easy to install. In sizes ¼ to 2 in. with screw-end or socket-welding end connections. Also available in 90 deg elbows.



Thermostat . . .

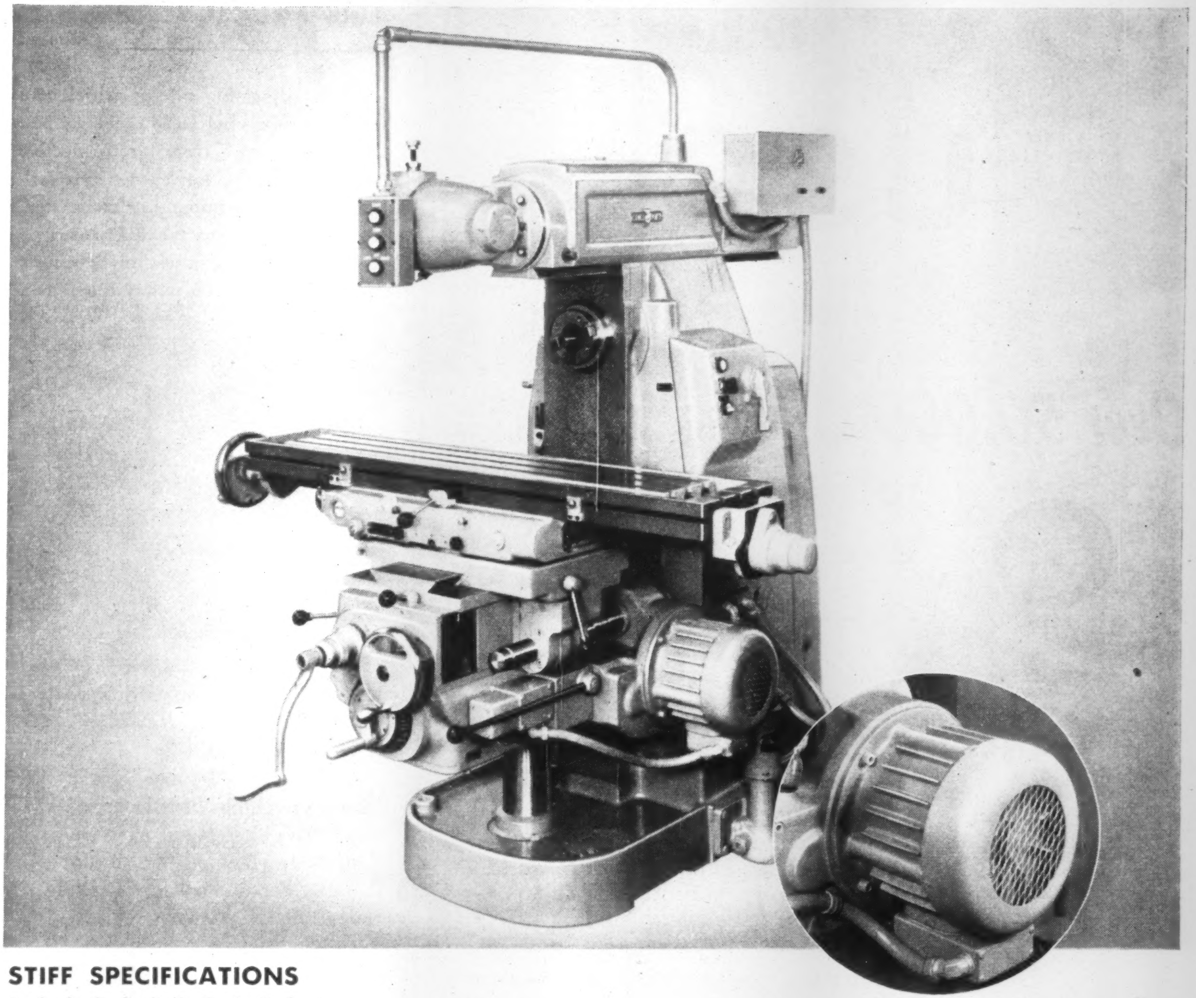
. . . for "automatic clock thermostat" control of heating, cooling functions with automatic night setback and morning pickup for each—*General Controls Co., Dept. HPAC, 801 Allen Ave., Glendale, Calif.*

"Tempotherm 365" adapts readily to most standard heating, cooling air conditioning systems, says company.



Borescope . . .

. . . for internal inspection of tanks, vessels, combustion chambers, other equipment—*Lenox Instrument Co., Dept. HPAC, 2010 Chancellor St., Philadelphia 3.*



STIFF SPECIFICATIONS

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Yet a DIEHL motor met all requirements

The requirements of one of the largest milling machine manufacturers called for a close-coupled, special duty motor to raise and lower the knee and develop sufficient torque for heavy table loads in rapid traverse without stalling. Cool operation was imperative to avoid distortion of the machine table due to heat transfer. The motor was to be mounted directly on the gear case, therefore complete protection against oil leakage into the motor was essential. Motor size, compactness and appearance were important factors. DIEHL developed the special totally enclosed motor illustrated, which met all desired requirements. Cool operation was assured by the fan-cooled design of the motor, effectively preventing heat transfer. The flat-type construction saved considerable space and overhang, conforming well with machine contours. Positive and dependable machine operation was the end result.

This is another example of DIEHL accomplishment based on almost three-quarters of a century of experience in the design and manufacture of motors for industry. Utilize this experience in the solution of your motor problems. We'll work closely with you to provide the right motor — at the right time — at the right price.

Diehl

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Electrical Division of
THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

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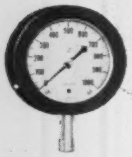

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Gauge for gauge—in every application classification—in every price range—you can't beat USG for value. USG has a line to meet every price and performance requirement.

SUPERGAUGE® LINE—With proper application, USG Supergauges will last a lifetime. USG Supergauges are world famous in process control for their *ruggedness*, *dependability* and enduring *accuracy*.

INDUSTRIAL CAST CASE LINE—For those applications where heavy duty service requirements do not demand the high accuracy of Supergauge construction.

DRAWN STEEL CASE LINE—The outstanding value in the low cost general purpose and domestic heating gauge field.

USG gauges are installed on 6 out of 10 original pieces of equipment . . . the selection by so many buyers who demand both quality and economy being proof of USG values.

For help with your gauge problems, call the nearest USG Distributor . . . his name is in the yellow pages of your phone book . . . or write the factory.

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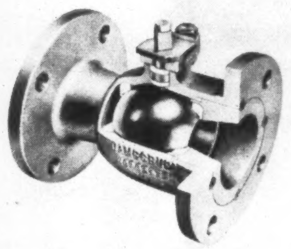
EQUIPMENT DEVELOPMENTS

Continued

Uses adjustable mirror which can be controlled by handwheel to permit scanning from retrospective through right angle to forward oblique, says company. Larger field of view is said to make it easier to detect flaws, pits, cracks or deterioration. Unit gives 10 power magnification.



Ball Valves . . .

. . . in new 3, 4 in. models—*Jamesbury Corp., Dept. HPAC, 45 New St., Worcester, Mass.*

Design of "Double Seal" units eliminates high turbulence, leakage tendencies often found, says company. Unit-body construction has no valve bonnet. Feature is said to assure no joint leakage points.

Fastening Tool . . .

. . . with single section rubber hand grip—*Ramset Fastening System, Olin Mathieson Chemical Corp., Dept. HPAC, 12117 Berea Rd., Cleveland.*

Feature is said to provide good protection, better grasping surface. Complete kit, including hammer, packaged in metal tool box. "Shure-Set" designed so that user, with energy supplied by swinging hammer, can sink special fastener into concrete or as much as $1/4$ in. of steel.

Halide Detector . . .

. . . for revealing fluorinated hydrocarbon refrigerant leaks in fittings, joints—*Kidde Mfg. Co., Inc., Dept. HPAC, Bloomfield, N.J.*

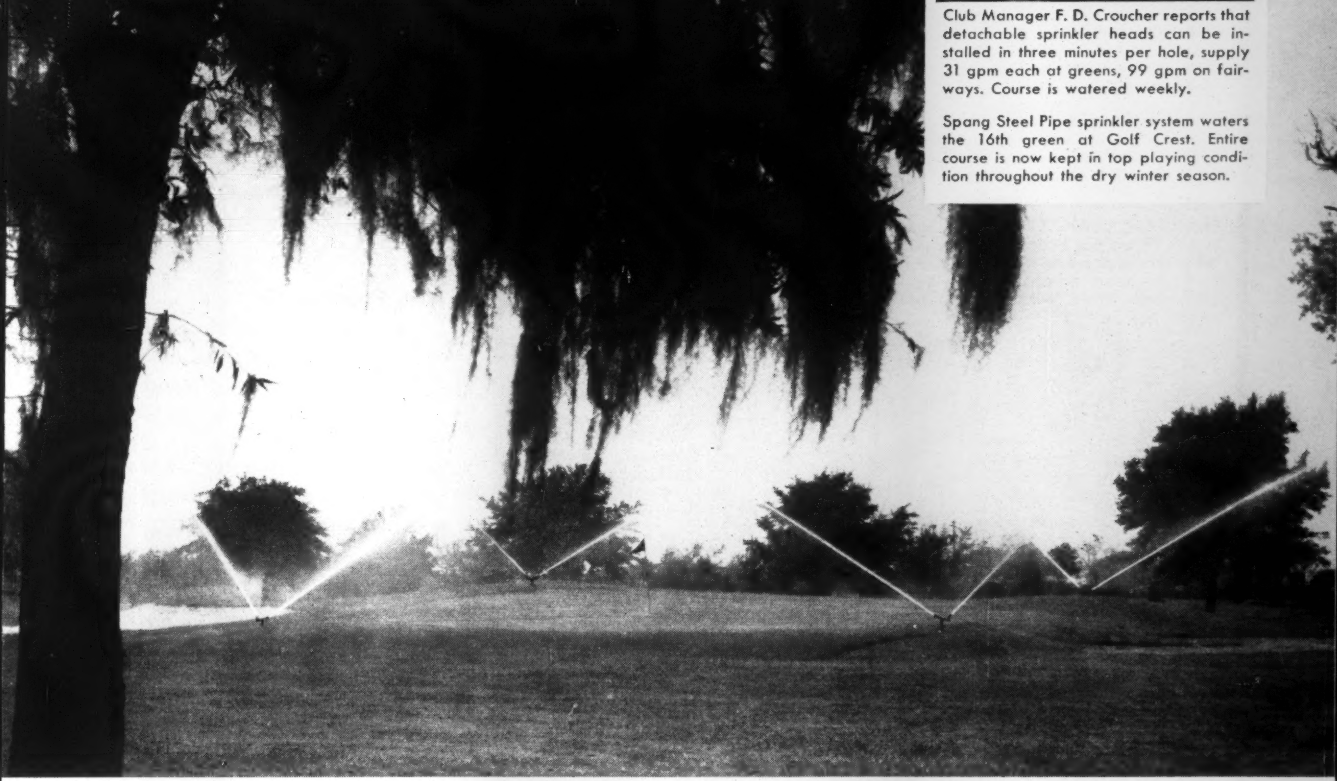
Operates as follows: Hold torch in one hand; with other, move opening of rubber tube over piping; if

"Our SPANG® steel pipe sprinkler system withstands ground heavage, cuts labor time 66⅔%"

—says Mr. F. D. Croucher, Manager, Golf Crest Country Club, Houston, Texas

Club Manager F. D. Croucher reports that detachable sprinkler heads can be installed in three minutes per hole, supply 31 gpm each at greens, 99 gpm on fairways. Course is watered weekly.

Spang Steel Pipe sprinkler system waters the 16th green at Golf Crest. Entire course is now kept in top playing condition throughout the dry winter season.



Piping Contractor: Cribbs Brothers, Houston, Texas; Spang Distributor: Hamilton Supply Co., Galena Park, Texas

27,000 ft. of SPANG Pipe keep golf course green in dry months

"It used to take one man eight hours, six days a week, to water the 116-acre Golf Crest course, hauling hoses, making connections and shifting equipment," says Mr. Croucher. "Ground heavage, peculiar to this area, often caused underground pipe breaks, and repairs interfered with members' games. Some course areas were too remote for watering and were in poor condition.

"To correct this, we installed a permanent sprinkling system, using 27,000 ft. of SPANG Steel Pipe. The pipe was welded at the joints, coated and wrapped, and laid in pipe-line fashion 24 inches below ground surface down the center of the fairways.

"Detachable head connections are located on 90-ft. centers on fairways. Four outlets serve each green, each tee has one. Water is drawn from three lakes on the course.

"As a result, time required to water the course was reduced from 48 to 16 hours. Only manual labor now required is attaching sprinkler heads and operating the system. The SPANG Pipe is flexible enough to withstand the stresses of earth heavage, and we have no leaks or breaks, which also saves us money. We know we will get at least 25 years service from this sprinkler system."

MAKE YOUR NEXT PIPE INSTALLATION SPANG!

You'll get years of reliable, built-in service with *quality-controlled* SPANG Steel Pipe on any piping job. Uniformity throughout means easy installation, time saved, money saved. Let your nearby SPANG Distributor serve you.

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DIVISION OF THE NATIONAL SUPPLY COMPANY
General Sales Offices:
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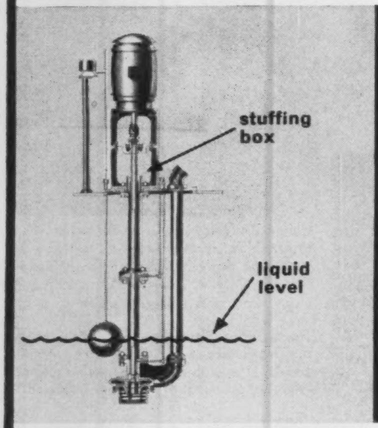
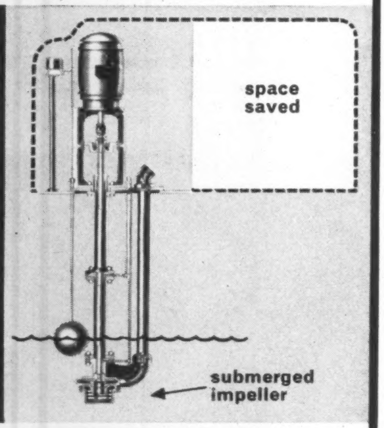
SPANG® CW STEEL PIPE

you stop leakage, save space, and cut costs with Yeomans

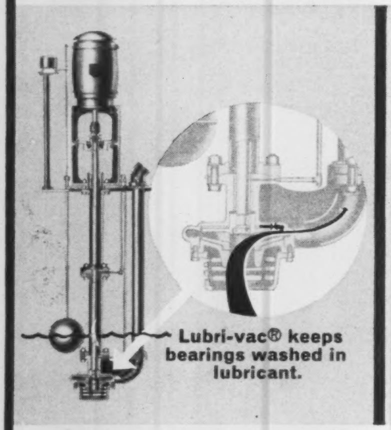
VERTICAL WET PIT PUMPS



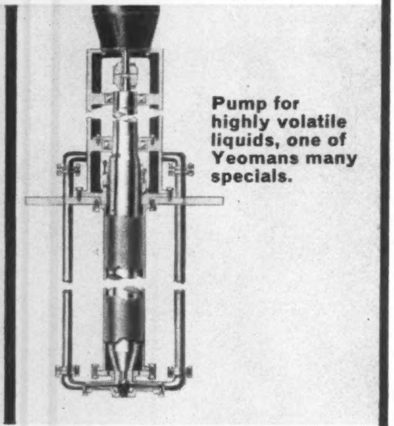
ELIMINATE LEAKAGE. Stuffing boxes and seals are not under liquid pressure. With the Yeomans Vertical Wet Pit Pump there are no costly, annoying, or dangerous liquid leaks, as with horizontal pumps.



SAVE FLOOR SPACE. They use less than half the space required by horizontal pumps. Also, no priming equipment is needed as with suction lift horizontals. Impellers are submerged in the liquid ready for service.



CUT MAINTENANCE COSTS. With exclusive Lubri-vac® bearings are kept free of abrasive matter. Lubricant pressure prevents fluids from working into bearings. Result: Bearing failures are 90% less than with conventional vertical wet pit pumps.


Pump for highly volatile liquids, one of Yeomans many specials.

SPECIAL DESIGNS. 59 Years of experience has enabled Yeomans to develop many excellent special designs for pumping "problem materials." All pumps can be furnished with ferrous and nonferrous alloy parts as required.

Capacity range from 5 to 10,000 g.p.m.

YEOMANS PUMPS · YEOMAN SERVICE

YEOMANS

Manufacturers of: pumps for drainage • sewage • condensation return • water supply and circulation • equipment for treatment of domestic and industrial wastes.

Yeomans, 2000- N. Ruby Street, Melrose Park, Illinois

Please send me the catalog on Yeomans Heavy-Duty Vertical Wet Pit Pumps for...

☐ solids-free liquids

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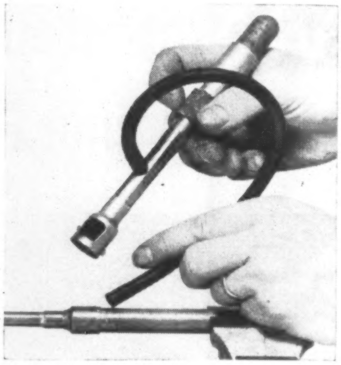


refrigerant is present torch will emit brilliant green flame. Torch, with rubber tube removed, supplies 30 min of 3500 F flame for soldering of wires, pipe, similar applications.

Air Freshener . . .

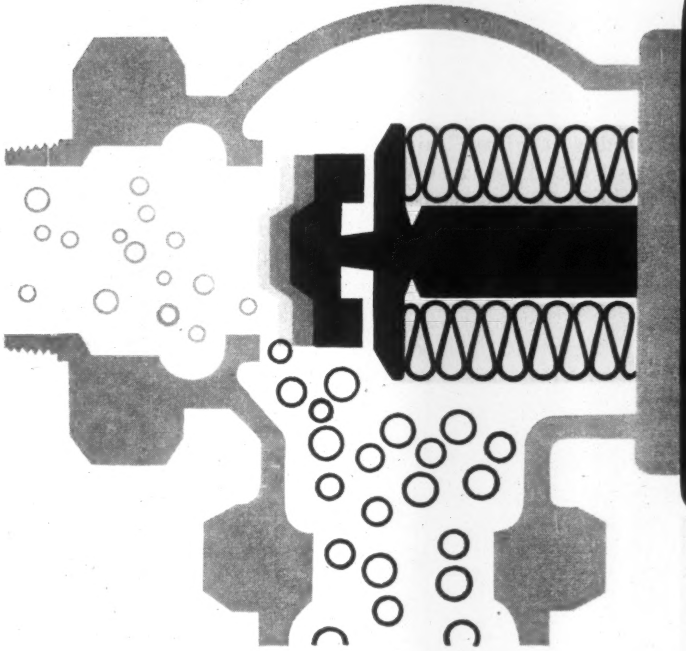
. . . designed to neutralize unwanted odors—*Williams Chemical Co., Dept. HPAC, 487 Broadway, New York.*

Will deodorize areas up to 7500 cu ft, says company. For use in rooms where customers, employees, others would be subject to unpleasant odors. Plugs into any a-c electric outlet.

Cylindrical Slide Rule . . .

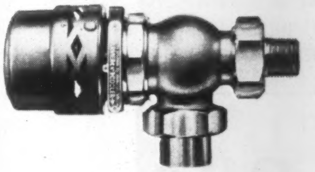
. . . designed for high accuracy, compactness—*Arthur F. Smith Co., Dept. HPAC, 311 Alexander St., Rochester, N. Y.*

Calculator, by spiraling scales around tube instead of in straight line, achieves graduations equal to those of 66 in. slide rule, says company. Size when closed is 6 in. long × 1¼ in. diameter. ⧧



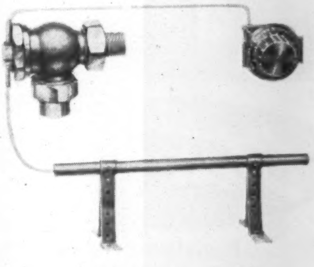
Anyone can afford room temperature control the Fulton Sylphon way

With Fulton Sylphon Automatic Radiator Valves, individual room temperature control is practical and economical for any building heated by steam or hot water radiation systems. First off, this type of control costs less than most. Your installation costs are lower because there is no electrical wiring, piping, or accessory equipment. Owner operating costs are lower because these self-operated valves require no outside source of power. And unlike "on-off" controls, they *throttle* heat input *continuously*. This action not only conserves the heat supply medium, but also keeps rooms from alternating between "boiling hot" and "stone cold."



FOR EXPOSED RADIATORS

No. 885 Automatic Radiator Valve is not only self-powered, but also self-contained so that it simply installs in place of the hand valve. For either steam or hot water systems. A turn of the valve head sets it to maintain any temperature between 60° and 75° F. Packless valve eliminates maintenance problems. ½'', ¾'' and 1'' valves. No. 885 Valve can also be used with convectors and finned pipe.



CONVECTORS • CONCEALED RADIATORS

The No. 895 Automatic Radiator Valve is designed especially for the regulating and installation requirements of enclosed steam, vapor or vacuum units. Only the control knob shows. Adjusts instantly for any temperature from 40° to 90° F. Valve is packless . . . no packing replacement problems. Valve sizes ½'', ¾'' and 1''. Fulton Sylphon offers Model No. 522-A for hot water installations.

SEND FOR CATALOG BULLETIN NH-80

Mr Controls

Robertshaw-Fulton
CONTROLS COMPANY
FULTON SYLPHON DIVISION • Knoxville 1, Tennessee

RECENT TRADE LITERATURE . . .

▶ *ABRASIVE CUTTING MACHINES*—Revised bulletin features various "Speed-Cut" abrasive cutting machines. Models included are standard floor model, bench or tripod model, "Any-Angle" floor model, wet cutting floor model, oscillating floor model, "Hi-Boy" floor model, car trailer model—gas engine or motor driven. *Beaver Pipe Tools, Inc., Dept. HPAC, Warren, Ohio.*

▶ *AIR BRAKE OPERATORS*—Line of air brake power operators for actuating "Rockwell-Nordstrom" screwed-gland type, wrench-operated valves cataloged in 4 page bulletin V-604. Size, cylinder diameter, cylinder stroke, list price included in listing of operating conditions. *Rockwell Mfg. Co., Meter and Valve Div., Dept. HPAC, 400 N. Lexington Ave., Pittsburgh 8.*

▶ *AIR CONDITIONING*—*Bulletin* D-425B outlines proper method of balancing induction "UniTrane" air conditioning systems. Prepared principally as guide for contractors, literature uses photographs, text, graphs to describe step-by-step balancing procedure. *Trane Co., Dept. HPAC, La Crosse, Wis.*

▶ *AIR CONDITIONING, HEATING, REFRIGERATION*—Wholesale buyers' guide No. 57 contains 116 pages covering parts, tools, equipment, supplies for air conditioning, heating, refrigeration contractors and service men. *Airo Supply Co., Inc., Dept. HPAC,* 2730 *N. Ashland Ave., Chicago* 14.

▶ *AIR CONDITIONING, REFRIGERATION*—Catalog CC-1 describes company's line of air conditioning and refrigeration products. Covers newly expanded commercial line, along with dimensions, connections, shipping weights. *Betz Div., Bohn Aluminum & Brass Corp., Dept. HPAC, Danville, Ill.*

▶ *AIR CONDITIONING UNITS*—New 32 page catalog 54C7c features 18 pages of performance data covering line of air conditioners designed to handle to 21,000 cfm. Data covers performance of units 400 to 6000 fpm face velocity, with chilled water and direct expansion selections at six different conditions, allowing interpolation; as well as steam and hot water selection data at three different conditions. *Recold Corp., Dept. HPAC,* 7250 *E. Slauson Ave., Los Angeles.*

▶ *AIR CONDITIONING UNITS*—Company's line of "Multi-Zone" air conditioning units detailed in 36 page bulletin No. C-1100-B98 P. Literature contains specification and physical data of units' component

QUALITY **where it shows!**

Stewart

REGISTERS and GRILLES

Registers must be functional, of course. But today's standards in decor require more than performance. Stainless steel trim calls for stainless steel accessories, wood paneling for bronze, aluminum must have aluminum for harmony.

Because Stewart has the know-how and artistry to produce in special metals, we can offer our standard directional-type outlets in all-stainless steel, all-bronze, all-aluminum, chromium plate, etcetera.

Our representatives, or home office, will be pleased to supply information for specific applications.

STEWART
manufacturing company, inc.
Cedar Grove, New Jersey

RECENT TRADE LITERATURE

Continued

parts, engineering and design features, direct expansion cooling coil data and ratings, sample problem tables for chilled water cooling coils and hot water heating coils, other information. *Worthington Corp., Dept. HPAC, Harrison, N.J.*

▶ *AIR COOLED CONDENSERS*—Literature 34C7A contains specifications, dimensions for "Dricon" air cooled condensers. Includes condenser performance chart, which is said to correct ratings not only for variations in suction temperature, but also for variations in condensing temperature. *Recold Corp., Dept. HPAC, 7250 E. Slauson Ave., Los Angeles.*

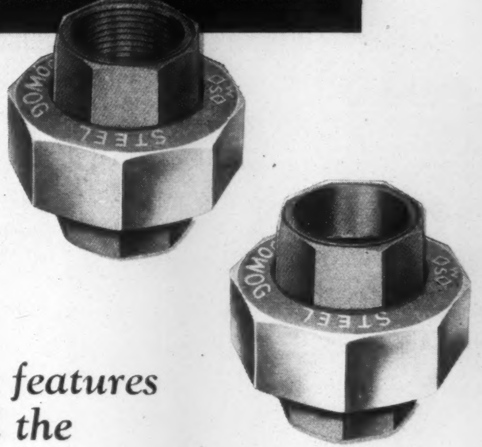
▶ *AIR DIFFUSION EQUIPMENT*—New 66 page catalog No. 1-57 describes, illustrates line of grilles, registers. In addition to photographs and drawings, literature contains selection tables for each of 26 standard sizes. *Waterloo Register Co., Inc., Dept. HPAC, P.O. Box 72, Waterloo, Iowa.*

▶ *ASBESTOS TEXTILES*—New 16 page bulletin 76-327 designed to aid engineer in selecting asbestos textiles for any application or temperature range. Products covered include cloth, tape, tubing, lap, roving, cord, wick, rope. *Union Asbestos & Rubber Co., Fibrous Products Div., Dept. HPAC, 1111 W. Perry St., Bloomington, Ill.*

▶ *BOILER-BURNER UNITS*—Line of water tube boiler-burner units described in bulletin No. 900. Units are said to have performance features of water tube boilers, plus advantages of burner selection, separate delivery and local service. Models available in capacities 670,000 to 20,100,000 Btu per hr hot water, 20 to 600 hp steam. *International Boiler Works Co., Dept. HPAC, 603 Willow St., East Stroudsburg, Pa.*

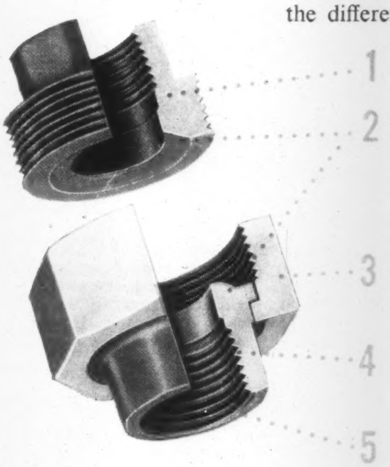
▶ *BOILER WATER LEVEL CONTROLS*—One side of wall chart

W-S Forged Steel Unions



. . . these features tell the difference . . .

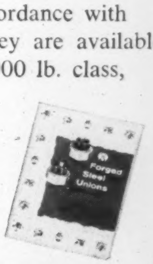
Not all forged steel fittings are alike. Careful design and precision manufacture give W-S Forged Steel Unions these important features that tell the difference:



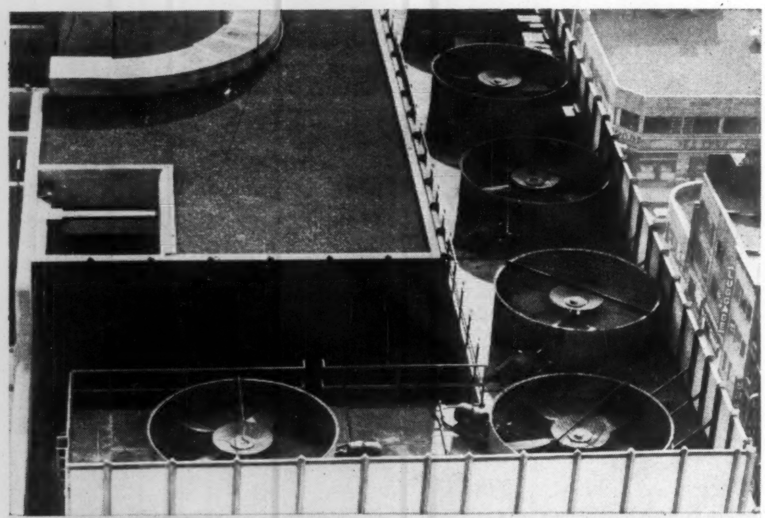
1 Designed to AAR dimensional specifications.
2 Steel-to-steel seats, with spherical-to-angle mating surfaces. Angle is rolled to extra hardness to resist galling.
3 Cadmium plated nuts for resistance to corrosion and to galling and siezing.
4 End pieces protected against rust by new W-S blue synthetic coating.
5 Octagonal end pieces for better gripping.

W-S Unions are machined from forged steel in accordance with ASTM material specifications A-105, Grade 2. They are available with screw-end and socket-welding end pieces in 3000 lb. class, sizes 1/8" to 3".

For complete information send for Bulletin U-1. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.



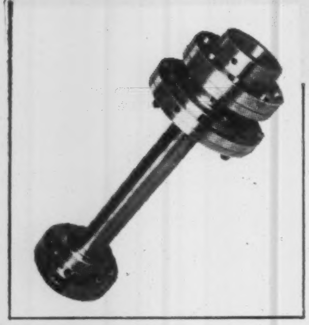
HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.



Waldron floating shaft couplings used on nine Phillips Cooling Towers

WALDRON

flexible couplings...



Waldron floating shaft shear pin coupling

USED IN HUNDREDS
OF DIFFERENT APPLICATIONS
BUT ALWAYS FOR THE

same 3 reasons

1 **STRENGTH** —Hubs and cover sleeves for sizes 1¼A through 7A are machined from tough steel forgings. Hubs are keyed to the shafts. The two one-piece cover sleeves function as a single, rigid unit serving as a floating connecting link between the hubs. High strength of forgings makes possible a very compact coupling with low rotating inertia.

2 **RELIABILITY** —There are no flexible parts to bend or break and the coupling is dust, moisture, and oil tight. Patented Walflex seal is positioned where centrifugal force is least. Clearance between teeth in hubs and sleeve is engineered so that an oil wedge always separates them, taking the wear.

3 **SERVICE** —Plenty of rough bore couplings, already assembled—on the shelf for *immediate* delivery. Finish bored standard couplings shipped to meet customers' schedules. We are geared up to give you realistic delivery on *any* type of couplings.

Ask for Catalog 57

JOHN **WALDRON** CORP.
NEW BRUNSWICK, NEW JERSEY
Representatives In Principal Cities
Export Agents—Frazar & Co., New York, N. Y.

RECENT TRADE LITERATURE

Continued

covers company's boiler feeders, cutoffs, pump controls, relief valves; while other side discusses medium pressure boiler jobs—up to 150 psi. *McDonnell & Miller, Inc., Dept. HPAC, 3500 N. Spaulding Ave., Chicago* 18.

▶ *BOILERS*—New 8 page brochure details line of "Model CB" self contained boilers for heating and processing steam or hot water. Cited features of units are: unusual fuel flexibility; four-pass, forced draft design; unified electric and steam preheater; quiet, vibrationless impeller; hinged doors with built-in refractory. *Cleaver-Brooks Co., Dept. HPAC, 326 E. Keefe Ave., Milwaukee* 12.

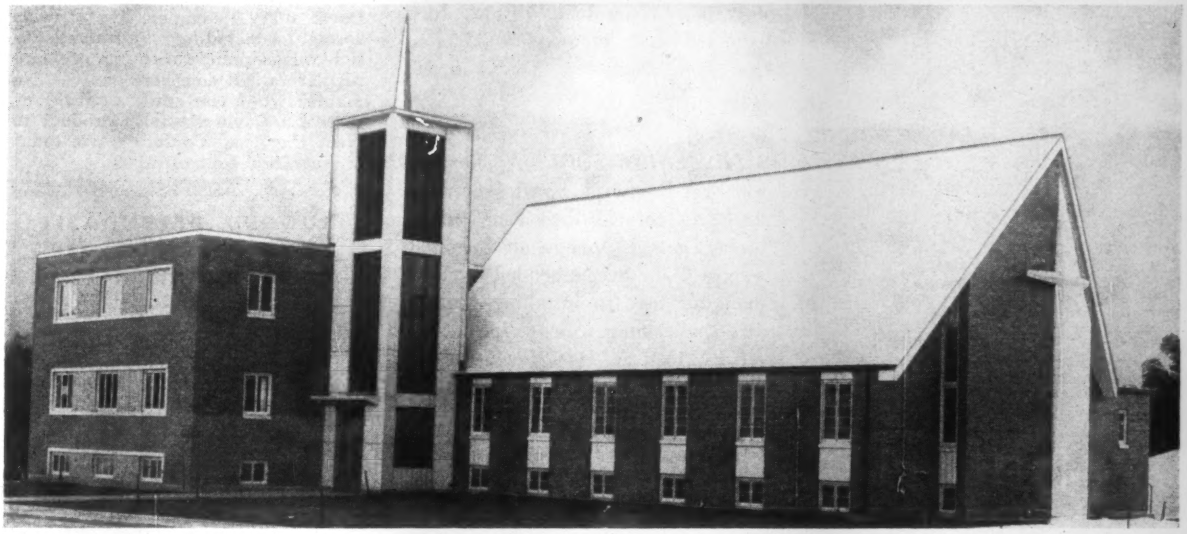
▶ *BRASS TUBE FITTINGS*—New 48 page catalog lists all sizes, types of brass fittings in company's line. Includes section showing drain and shutoff cocks. Also covered are push-pull controls, assembly instructions, data on right and wrong ways for tubing a system, tube fitting data, tools. *Weatherhead Co., Dept. HPAC, 128 W. Washington Blvd., Ft. Wayne, Ind.*

▶ *DETERMINING PIPE FRICTION LOSSES*—Pocket slide calculator figures water pipe and paper stock pipe friction losses. Data for computing water pipe friction loss are based on Hydraulic Institute standards and appear on one side of calculator while those for determining paper stock pipe friction loss are on other side. *Allis-Chalmers Mfg. Co., Dept. HPAC,* 1171 *S. 70th St., Milwaukee* 1.

▶ *DIRECT FIRED HEATERS*—Description, specifications for stainless steel direct fired heaters included in new bulletin F-57A-RO. Units designed for large commercial, industrial space heating applications. Line includes models in 10 sizes 400,000 to 2 million Btu for gas, oil or dual fuel firing. *Reznor Mfg. Co., Dept. HPAC, Mercer, Pa.*

Campbell

WARM AIR HEATERS FOR LARGE BUILDINGS



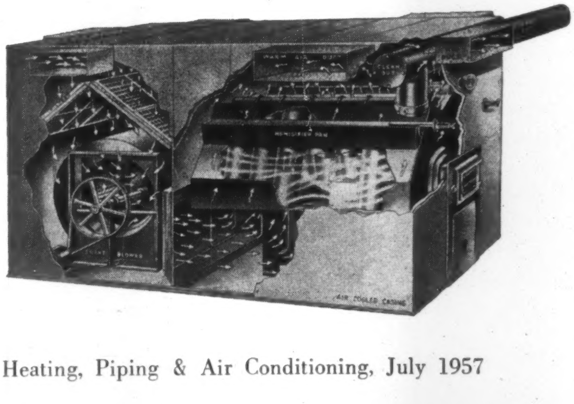
United Brethren Church, Bismarck, N. D., comfortably heated with a Campbell #8100 gas-fired heater. Architect, H. M. Leonard, Bismarck. Installed by Gerlach Sheet Metal Works, Bismarck.

MODERN, LOW COST HEATING

Campbell warm air heaters deliver the maximum in economy and flexibility for church heating. Low in first cost, easy to install, and remarkably economical to operate. They deliver the quick, abundant heat that is necessary for the "on and off" operation that is characteristic in churches. They provide effective control of humidity and ventilation, and are easily adapted for summer air conditioning. On your next church heating job, build your plans around a Campbell Heater!

MANUFACTURERS' AGENTS:

We have some very attractive openings for men calling on heating contractors and architects.



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HEATING COMPANY

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use Chicago Airfoil Fans

Its aerodynamically designed blades reduce noise level 65%, cut horse power requirements 35%. Capacities, 600 to 1,000,000 cfm.

Write for Bulletin A-102H

CHARTER MEMBER of A.M.C.A.

CHICAGO BLOWER CORP.

9869 Pacific Ave., Franklin Park, Ill.

See Phone Directory for Sales Offices

RECENT TRADE LITERATURE

Continued

▶ *FANS*—"SP-7" semi-pressure fans, designed for efficient performance against static pressure normally considered above range of propeller type fans, described and illustrated in bulletin No. 400. Units available in direct connected, direct driven duct, belt driven duct, "Bi-Flo" duct, extended shaft types. *Aerovent Fan Co., Inc., Dept. HPAC, Piqua 29, Ohio.*

▶ *FASTENING TOOL*—Applications for "Fix-Rammer" powder actuated fastening tool described in new literature. Unit is one-hand operated, weighs 4 lb. Recommended by company for uses in installing heating, air conditioning. *Sileps, Inc., Dept. HPAC,* 1501 *N. Davidson St., P. O. Box* 3721, *Charlotte, N. C.*

▶ *FILING SYSTEM*—"Stikfile" filing system—designed as fast, economical, versatile method for filing blueprints, drawings, plans, tracings—presented in new folder. Literature illustrates, gives dimension and price information for various models. *Dancer "Stikfile" Co., Dept. HPAC, P. O. Box* 10221, *Houston* 18.

▶ *FUME HOODS*—New 48 page catalog on fume hoods is illustrated with installation photographs, elevation and roughing-in drawings, and includes engineering data and recommendations, operating characteristics, operating cost comparisons. *Kewaunee Mfg. Co., Dept. HPAC,* 5123 *S. Center St., Adrian, Mich.*

▶ *GAS HEATING EQUIPMENT*—Gas fired commercial, industrial heating equipment presented in 20 page catalog GN-57. Equipment includes suspended gas unit heaters, "Flexitemp" floor model heater, two series of duct furnaces, "PAC" horizontal furnace. Literature covers specifications, construction details; includes installation information, application ideas. *Reznor Mfg. Co., Dept. HPAC, Mercer, Pa.*

DAVIS

VALVE SPECIALTIES FOR STEAM, AIR OR GAS

Davis offers a complete line of valve specialties including relief valves, altitude valves, pump governors, pressure regulators and emergency valves. No matter what the control problem, there's a Davis specialty product to meet the need. Contact Davis today for precision control valves.

RUGGED, DEPENDABLE STRAINERS FOR AIR-CONDITIONING SYSTEMS

Davis builds a high quality line of strainers that are ideal for installing in today's modern commercial air conditioning systems. They are easy to service and are available in a wide range of sizes. Three of the most widely used are shown below:

No. 75 "Y" TYPE

Bolted cap "Y" Type Strainer for easy access for cleaning. Blowoff at lowest point—no sediment pocket! Complete range of sizes: 3/8" to 14"... available in semi-steel, bronze or steel bodies, screwed or flanged. Brass, stainless or monel screens. For steam, air, gas or fluids . . . pressures to 1500 psi.

No. 76 BASKET TYPE

The No. 76 Strainer has a cylindrical basket with perforated sides and bottom — easily lifted out for cleaning. Large body passage for low pressure drop. Sizes 1/2" to 24"... bronze, semi-steel or steel bodies . . . brass, stainless, monel steel baskets . . . special meshes available. Ask for recommendations.

No. 77 BASKET TYPE

Similar to No. 76 except for applications where lowest possible pressure drop is desired.

WRITE FOR BULLETIN 800

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DAVIS REGULATOR COMPANY

2541 So. Washtenaw • Chicago 8, Illinois

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Every week, scientists and engineers from all over the country arrive at Argonne to begin their work at this center of research and development studies in nuclear science. They have selected Argonne, recognizing the value of an organization whose interests include physics, chemistry, biology, metallurgy, applied mathematics and electronics; as well as nuclear, chemical, and mechanical engineering.

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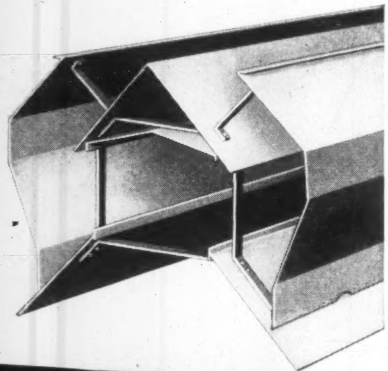
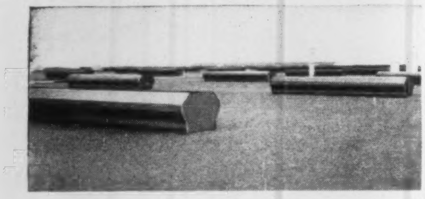
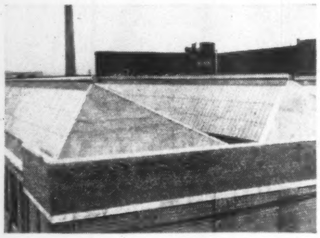
P. O. BOX 299 • LEMONT, ILLINOIS

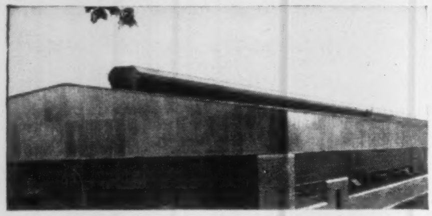
Thousands of buildings efficiently ventilated by



Swartwout Heat Valve®







...the *original* continuous roof ventilator

Heat Valve is designed for maximum capacity with least possible friction in all its throat sizes — 4″ to 42″ — ten in all. Its contour invites assistance from outside air currents to *pull* unwanted heat, smoke and fumes out of the building. Made in ten-foot lengths as standard, Heat Valve is adaptable to any need — from single sections spotted where most needed, to continuous runs the length of the roof.

Any roof style — peak, slope, flat, saw-tooth — accommodates Swartwout Heat Valve. Ventilator is always weatherproof. Adjustable damper controlled by several optional methods, any position from tight closed to wide open.

You can provide practically any area of roof opening desired with this efficient gravity ventilation, at economical cost. Thousands of miles of Heat Valve used on many types of buildings since its introduction by Swartwout in 1934 . . . Write for fully illustrated Bulletin HV-F.

The Swartwout Company
18511 Euclid Avenue **Cleveland 12, Ohio**
Representatives in all principal cities

Swartwout **ROOF VENTILATORS AND VENTILATING LOUVERS**

ALSO AUTRONIC PROCESS CONTROL EQUIPMENT

RECENT TRADE LITERATURE

Continued

▶ *GAS REGULATORS*—New 40 page catalog covers line of pressure regulators for industrial compressed gases. Deals with various types of cylinder, manifold, and pipeline regulators, both single- and two-stage, and variety of specialized equipment such as laboratory and metering regulators and gas proportioners. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC,* 150 *E.* 42*nd St., New York* 17.

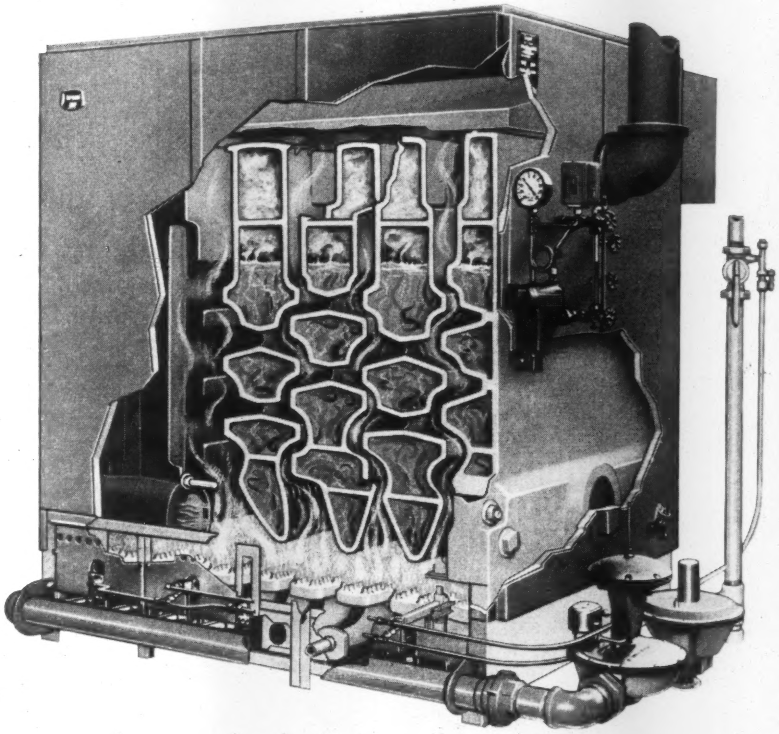
▶ *HEATING ELEMENTS*—Technical data describes solutions to four difficult heating problems due to odd contour shapes, space and/or weight limitations. Covers sprayed-on, film type heating elements said to be very light in weight, save space. *Electrofilm, Inc., Dept. HPAC, P. O. Box* 106, *North Hollywood, Calif.*

▶ *HOSE, HOSE ENDS, ASSEMBLIES*—New 40 page catalog incorporates information on bulk industrial hose, permanently attached hose assemblies, swaged hose assemblies and ends, hose and swivel adapters, assembly instructions, installation data. *Weatherhead Co., Ft. Wayne Div., Dept. HPAC,* 128 *W. Washington Blvd., Ft. Wayne, Ind.*

▶ *INSTRUMENTATION, CONTROL*—Digest of specifications of instruments and controls offered in new 12 page condensed catalog, publication 57-687-297. Covers controls for pressure, flow, temperature, level, gas analysis and receivers and controllers. *Hays Corp., Dept. HPAC, Michigan City, Ind.*

▶ *INSULATION*—Six specifications cover application of "Foamglas" insulation for use on industrial equipment, piping. By number and subject, these are: FI-104A—low temperature equipment and piping (below 70 F); FI-104B—medium temperature equipment and piping (70 to 212 F); FI-104C—high temperature equipment and piping (over 212

Finest in the nation for church, school, industrial or commercial installation!



Bryant Model 630 Boiler

EASIEST TO SELL! The 630 is the owner's assurance of more economical operation, longer life, less servicing, maximum comfort.

EASIEST TO INSTALL! Installing Bryant means more money in your pocket—because you save on time, labor, and materials.

PROBLEMS? Trained experts at the factory and field levels are available to assist you with installation or application problems.

RUSHED FOR TIME? Bryant offers you IMMEDIATE DELIVERY.

AND REMEMBER—Bryant is rated FIRST by leading utilities, architects, and engineers everywhere.

In addition to the 630, the Bryant 26, 225, and 446 models round out the most complete line of gas fired boilers in the industry.

For further information contact your nearest Bryant distributor or write us directly. We'll be glad to furnish you more details.

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50 YEARS OF ENGINEERING SKILL, RESEARCH AND DEVELOPMENT ARE PACKED INTO THE 630

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for a "beautiful" job of distributing air where you want it!

Specify the NEW Lima Flexi-Trol COMMERCIAL AIR CONDITIONING REGISTERS and GRILLES

Completely Adjustable

COMPLETE AIR CONTROL

STURDY CONSTRUCTION

LASTING BEAUTY

In air conditioning, complete air control is most important. Lima single and double deflection registers have horizontal and vertical face bars that can be easily adjusted to provide any air pattern desired.

You'll agree that the construction and finish of air conditioning grilles and registers are important too. Lima Registers have one-piece rigidity. All joints are welded and corners are reinforced for extra strength . . . no rattles in high velocity air streams.

Lima durable beige enamel finish is electrostatically applied for uniform coverage and protection and then baked on for lasting beauty. May be repainted if desired.

Write today for literature and specifications on the new Lima Flexi-Trol Commercial Air Conditioning Line.

Lima REGISTER COMPANY

1796 N. Cable Rd., Lima, Ohio

sold exclusively through wholesalers and manufacturers

RECENT TRADE LITERATURE

Continued

F); FI-104D—dual temperature equipment and piping (—300 to 400 F); FI-104E—underground piping; FI-104F—insulation on spheres (70 down to —25 F). *Pittsburgh Corning Corp., Dept. HPAC, 1 Gateway Center, Pittsburgh 22.*

▶ *MECHANICAL SEALS*—Information on mechanical seals and sealing systems for boiler feed pumps, other hot water pumps, contained in 4 page form S-230. Bulletin gives technical and installation data, cites economy features. *Crane Packing Co., Dept. HPAC, 6400 Oakton St., Morton Grove, Ill.*

▶ *MOTORS*—*How to Make a Motor Go. . . and Go, and Go, and Go* and *How to Take Step Seven* are titles of bulletins 51X8582 and 51X8581, respectively. Literature depicts by means of cartoon characters how to install, properly maintain electric motors. *Allis-Chalmers Mfg. Co., Dept. HPAC, 1171 S. 70th St., Milwaukee 1.*

▶ *MOTORS*—Condensed catalog for 1957, 4 pages, covers current pricing for 1/20 to 200 hp motor sizes on general purpose fractional and integral hp motors. Includes slide base dimensions with diagrams, adapter information. Standard modifications, dimensional drawings also presented. *Marathon Electric Mfg. Corp., Dept. HPAC, Wausau, Wis.*

▶ *MOTORS*—Eight page booklet, *The Moving Force of Industry*, describes, illustrates line of a-c, d-c motors, gearmotors, motor-generator sets, motor controls, packaged mechanical and electronic adjustable speed drives. *Reliance Electric and Engineering Co., Dept. HPAC, 24701 Euclid Ave., Cleveland 17.*

▶ *MOTORS, TIMERS*—Two new bulletins designed to aid in ordering special timers or motors. Bulletin AWH MS101 is applications data

INSTALLING CONTRACTOR O. A. WENDT COMPANY, CHICAGO

1300 FEET of trench were needed, without special preparation or forms. Note simple concrete supports—no anchors are evident.

EXPANSION LOOP demands only additional GILSULATE on one side of each loop leg in the direction of expansion.

Midwest manufacturer chooses GILSULATE® for plant expansion program

New underground steam lines protected with Triple-Zone insulation system

When one of the world's largest manufacturers of heavy-duty engines expanded plant facilities, the company chose GILSULATE to insulate and protect their hot underground piping system. They knew that GILSULATE gives maximum insulation and corrosion protection against commonly-encountered underground conditions. And they knew too that GILSULATE's low cost for the *complete* installation could not be matched by any other underground pipe insulation.

This typical GILSULATE installation runs for 1300 feet from the plant's main boiler room to the new parts building. Included in the system are a 14-inch steam line, an 8-inch steam line, and a 6-inch condensate return. The line carries 150 pounds of steam pressure with superheat.

Your local GILSULATE distributor will be glad to show you all of the advantages of the modern, efficient GILSULATE Insulation System. Complete details are yours for the asking. Write the office nearest you today.

GILSULATE IS POURED AND TAMPED easily and quickly. Leap frog sheet metal forms conserve material; bulldozer handles backfill.

Facts about Gilsulate

1. EASY TO USE—just pour and tamp... pipe heat does the rest.
2. FORMS 3 ZONES of protection against heat loss and all hazards commonly encountered by hot buried pipes.
3. NEEDS NO HOUSING OR MECHANICAL SHEATHS: no mixing, special handling or equipment.
4. ONLY NEEDS NORMAL PIPE SPACING: for multiple pipe or cramped conditions.
5. THREE TYPES AVAILABLE:
   - Type A for 220°-300°F. temp. range
   - Type B for 300°-385°F. temp. range
   - Type C for 385°-520°F. temp. range

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THE TRIPLE-ZONE INSULATION SYSTEM FOR LIFETIME PROTECTION OF HOT UNDERGROUND PIPES

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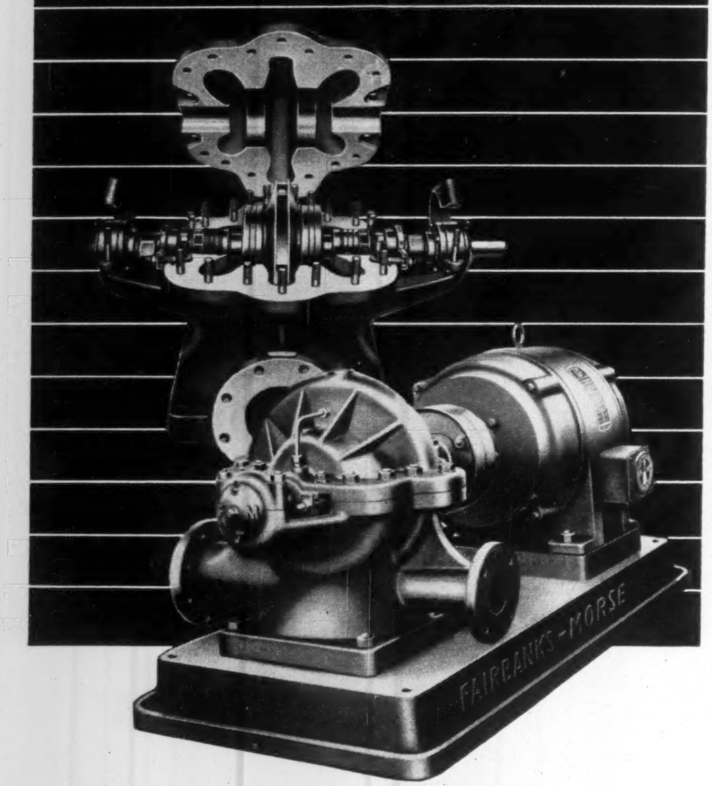

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Split-Case Centrifugal

Quick and easy to open, simple to service, these rugged Fairbanks-Morse pumps are known for low-cost, dependable operation throughout the heating, air conditioning and refrigeration industries.

With all points of wear located on the rotating assembly, new pump operation is easily maintained by replacing inexpensive parts. Removing rotating parts does not disturb pipe connections or the driver. Ball-bearing construction, centrifugally cast shaft sleeves, and wearing rings on both impeller and casing assure long, low-cost operating life with minimum maintenance. See your Fairbanks-Morse Dealer, or write Fairbanks, Morse & Co., Dept. HPA-7, 600 So. Michigan Ave., Chicago 5, Ill.

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RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

RECENT TRADE LITERATURE

Continued

sheet for motors and elapsed time indicators, while AWH MS102 covers relays. *A. W. Haydon Co., Dept. HPAC, Waterbury, Conn.*

▶ *PACKAGED AIR CONDITIONERS*—New 20 page bulletin 6125 describes 1957 models in company's line of packaged commercial air conditioning units. Design features detailed, illustrated. Cooling coils, fan, fan motor, compressor, condenser, controls discussed. *American Blower Div. of American-Standard, Dept. HPAC, Detroit 32.*

▶ *PIPE INSULATION*—"Mono-Kover" slit, one-piece section type mineral wool pipe insulation described in brochure No. J-432. Pamphlet explains, illustrates approved application methods. Thermal conductivity shown graphically for every temperature throughout operating range (to 350 F). *Baldwin-Hill Co., Dept. HPAC, 214 Breunig Ave., Trenton 2, N.J.*

▶ *PLASTIC PIPE*—Development, application, installation, specifications of "SP" plastic pipe detailed in catalog No. 401. Product is made from recently developed, new type polyethylene resin. *Orangeburg Mfg. Co., Dept. HPAC, Orangeburg, N. Y.*

▶ *PNEUMATIC CONTROL*—New 44 page bulletin on pneumatic control instruments features 10 pages of general automatic control theory. Describes, illustrates basic concepts of narrow band, proportional, reset, derivative, reset plus derivative control actions. *Bristol Co., Dept. HPAC, Waterbury 20, Conn.*

▶ *PNEUMATIC SPECIALTIES*—Filters, regulators, lubricators in company's line covered in folder F-15B. Literature includes illustration, description, operating data for each unit. Details filter-regulator-lubricator combination units. Various ac-

Every bearing noise tested
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Not even a whisper . . .

Louis Allis motors "hush" air conditioning systems

Cool and quiet . . . ideal for library concentration. And you can assure this combination when you include Louis Allis motors with the built-in "hush" in your air-conditioning equipment.

This silence is golden — for you and your customers. It's vital to systems for hotels, motels, hospitals, and other institutions where quiet comfort is a "must" . . . in offices for increasing employee efficiency.

You'll find that Louis Allis motors are specifically designed for quiet air-conditioning performance. All parts are skillfully made and precisely balanced for silent, vibration-free operation. Housings, bearings, and end brackets are thoroughly tested for quietness. The result: silence — no disturbing resonance during the operation cycle. Part-winding motors are available to reduce starting currents to meet power company requirements.

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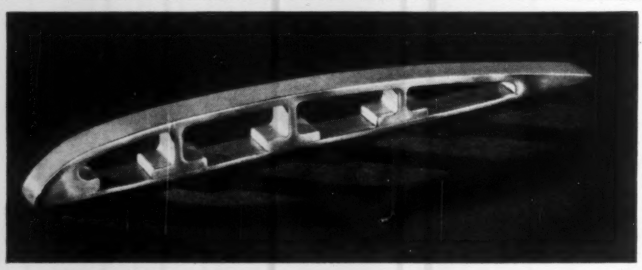

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AEROMASTER'S new, extruded aluminum blades combine in one design the advantages of a light weight metal, a hollow structure and the superior strength of wrought metal . . . Silicon-magnesium aluminum alloys resist corrosion. Their fine grain structure, high tensile strength and increased endurance eliminate danger from wear, vibration, and metal fatigue . . . true airfoil blade sections assure maximum air delivery . . . adjustable blade pitch angle permits decrease of fan load to an accurate minimum horsepower requirement.

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RECENT TRADE LITERATURE
Continued

cessories available also presented. *Watts Regulator Co., Industrial Div., Dept. HPAC, Lawrence, Mass.*

▶ *PROPELLERS*—Large diameter "Al-metal" propellers for cooling towers, heat exchangers described, illustrated in 4 page bulletin 510. Literature describes features, including cast aluminum blades designed to permit full interchangeability in any assembly, simplify installation and maintenance. *Aerovent Fan Co., Inc., Dept. HPAC, 700 E. Ash St., Piqua 29, Ohio.*

▶ *PUMPS*—Utility pumps designed with no vanes, turbines or impellers covered in new 4 page bulletin. Literature includes descriptions, illustrations, dimensional drawings, tables of dimensions and performance data. Describes direct-connected and v-belt motor driven models, gasoline engine driven units. *Continental Pump Co., Dept. HPAC, 1027 S. Vandeventer Ave., St. Louis 10.*

▶ *REFRIGERATING UNITS*—Low pressure refrigerating units described in 12 page bulletin No. 97-F. Photographs illustrate actual installations of company's equipment. Literature includes drawings showing typical designs of accessible-hermetic units, open drive units. *Frick Co., Dept. HPAC, Waynesboro, Pa.*

▶ *REVERSIBLE GEARED MOTORS*—"Type TYAZ-CE" reversible geared motors described in 4 page catalog GR2. Motors are designed for use in servomechanisms, voltage regulators, combustion and industrial controls. Available with voltages 6 to 220 volts, a-c, with starting torques to 50 lb in. *Barber-Colman Co., Small Motors Div., Dept. HPAC, 1400 Rock St., Rockford, Ill.*

▶ *SCREW PUMPS*—Basic construction, design of line of standard screw pumps shown in bulletin S-206. Featured are models of double external

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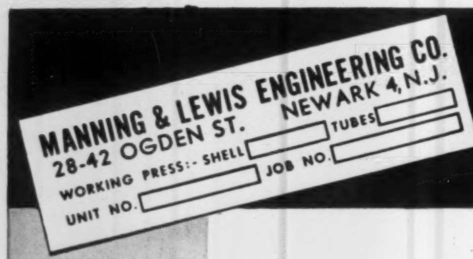
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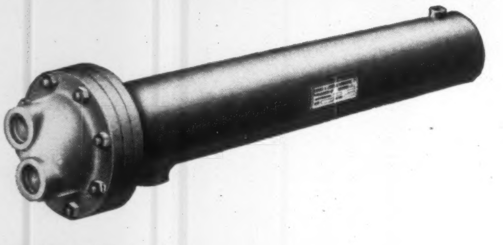

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FLEXAUST® HOSE
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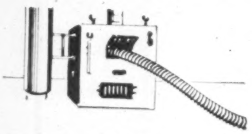
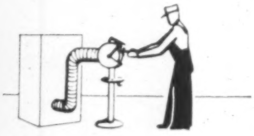
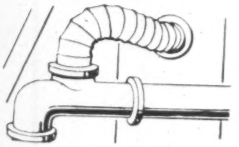


. . . in boiler cleaning,



. . . or grinding,



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RECENT TRADE LITERATURE

Continued

bearing and gear type, double external bearing and gear hopper type. *Warren Pumps, Inc., Dept. HPAC, Warren, Mass.*

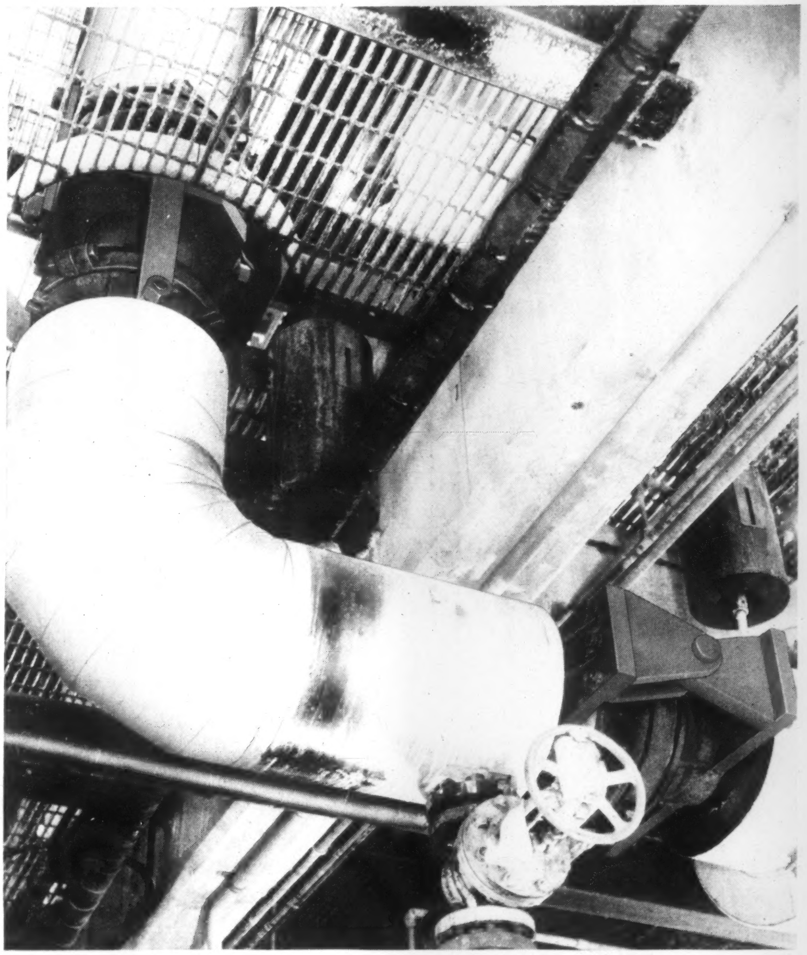
▶ *SPRAY BOOTHS*—Spray booths in range of types, sizes for many applications detailed in new 36 page catalog I-7000. Included are descriptions, specifications for custom design units and/or "ready made" units, which can be erected with only wrench and screwdriver, says company. Presented is information to aid in selection of right type, size. *DeVilbiss Co., Dept. HPAC, Toledo 1, Ohio.*

▶ *STEEL*—Revised bulletin No. 11-3 describes specially balanced composition for hardness and ductility, supplied in sheet and plate form for structures and equipment subjected to abrasion. Included is information on fabrication and heat treatment, along with performance records and illustrations of applications. *Joseph T. Ryerson & Son, Inc., Dept. HPAC, Box 8000-A, Chicago 80.*

▶ *STEEL TUBING*—Data card explains tolerances for steel tubing, pipe. Covered are seamless and welded mechanical tubing, seamless and welded stainless steel tubing and pipe. Gives permissible variations in OD, ID, wall, ovality, straightness. *Peter A. Frasse & Co., Inc., Dept. HPAC, 17 Grand St., New York 13.*

▶ *STOKERS*—New 12 page bulletin 456 illustrates, describes "Lo-set Ramfeed" stokers. Highlighted is synchronous combustion control designed to keep coal feed, forced air, stack draft in positive balance. "Turbo-aire" smoke control system also explained. *Canton Stoker Corp., Dept. HPAC, 300 Andrews Pl., S. W., Canton 1, Ohio.*

▶ *SUPPORT CLAMPS*—Twenty page engineering handbook covers usage of teflon in practical applica-



THIS IS WHAT

ADSCO

MEANS BY

SPECIAL

JOINTS

The photo shows a small but very important section of an insulated, spring-suspended 8″ pipe line in the new Moundsville, W. Va., plant of the National Aniline Division of Allied Chemical & Dye Corp. At the point shown, the line is subjected to complex stresses which are completely resolved and placed in balance by the ADSCO Gimbal Expansion Joint, upper left, and the ADSCO Hinge Expansion Joint, lower right.

In the Gimbal Joint, two sets of bars are pinned to the octagonal ring at 90° to each other. The other ends of the bars, still at 90° to each other, are pinned to the pipe leading into the joint. Running through the center of the ring, with a slight clearance, is a nipple connecting two expansion elements. This gimbal arrangement permits the joint to absorb 6° of angular movement from two different directions: the left and right motion of the horizontal part of the ell and similar motion from other unseen upper horizontal piping at 90° to the plane of the lower piping.

A partner to the Gimbal Joint and an indispensable part of this piping system is the Hinge Joint shown lower right. This absorbs the angular rotation of the ell caused by the expansion and contraction of the vertical piping.

There are so many motions involved in this section that, under certain conditions, the octagonal ring of the Gimbal Joint could describe a circle. Yet ADSCO and National Aniline engineers were able to identify all the motions and absorb them economically and efficiently by the Gimbal and Hinge Joints.

ADSCO designs and manufactures many types of both standard and special joints for many purposes. Consult ADSCO on any piping problem.

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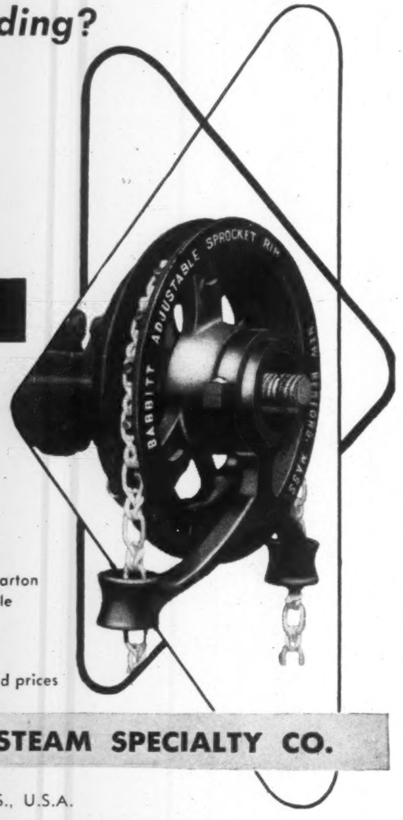
Babbitt
Adjustable
SPROCKET RIM
with Chain Guide



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- Operates any valve from plant floor
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Its *NEW* Hi-C "high capacity"...
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ELECTRONIC
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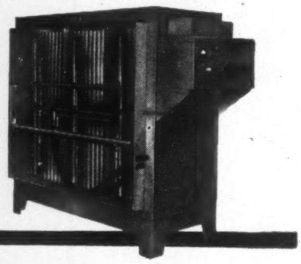

These entirely new Hi-C "High Capacity" units are designed for installation in forced air ventilating systems of commercial and industrial buildings and are engineered to give greater efficiency, increased capacity, and higher velocity.

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"High Capacity" units are manufactured with either horizontal or vertical air flow. All parts, including selenium rectifiers, are guaranteed for five years.

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ELECTRO-AIR CLEANER COMPANY, INC.
1285 REEDSDALE STREET, PITTSBURGH 33, PA.

RECENT TRADE LITERATURE

Continued

tions as cushioning, insulating material for supporting clamps. Illustrates seven models of teflon cushioned support clamps available in 18 standard sizes. *TA Mfg. Corp., Dept. HPAC*, 4607 *Alger St., Los Angeles* 39.

▶ *TEMPERATURE CONTROLS*—Automatic controls for heating, air conditioning, refrigeration illustrated, described in 40 page 1957 catalog. Literature includes new items such as "Fashion" room thermostats, "PushButton" heating-cooling thermostats, combination hot water limit-circulator relay controls, gas controls, shutoff automatic pilot. *White-Rodgers Co., Dept. HPAC*, 1209 *Cass Ave., St. Louis* 6.

▶ *THERMOMETER*—Redesigned "Adjust-Angle" industrial thermometer covered in literature. Unit available in 5, 7, 9, 12 in. sizes. May be installed at any angle before, during, or after installation by adjusting lock nut for stem and revolving case for best vision, says company. *Weksler Thermometer Corp., Dept. HPAC*, 195 *E. Merrick Rd., Freeport, L.I., N.Y.*

▶ *THERMOWELLS*—Expanded line of industrial thermowells described in bulletin No. D. Units designed to protect temperature sensing elements against mechanical injury, and corrosive or contaminating atmospheres. Literature contains details of various types available, both bar stock and built-up, alloys in which they are available. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

▶ *TRAPS*—"Series 27" float and thermostatic traps covered in new 2 page bulletin B-712F. Units available in five sizes with ¾, 1, 1¼, 1½, 2 in. tappings. Literature includes descriptions, illustrations, dimensional drawings, tables of dimensions and recommended ratings. *Warren Webster & Co., Dept. HPAC*,

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There is an improved way to apply insulation. Whether you're bonding insulation to piping or adhering lagging cloth to insulation, Swift's Lagging Adhesives give you 12 important advantages:

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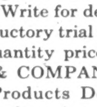

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RECENT TRADE LITERATURE

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17th and Federal Sts., Camden 5, N. J.

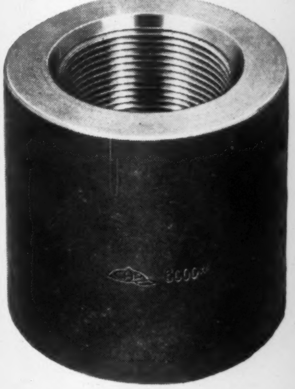
▶ *TUBING, PIPING*—Bulletins 145A, 152A designed for users of tubing and piping at elevated pressures, temperatures. Bulletin 145A discusses "Croloy 2 1/4," while 152A deals with "Croloy 1 1/4." Folders present technical data on analysis, mechanical and physical properties, fabrication, heat treatment, maximum allowable working pressures. *Babcock & Wilcox Co., Tubular Products Div., Dept. HPAC, Beaver Falls, Pa.*

▶ *VALVES*—*Valves for Automation in the Steel Mills* is title of new 16 page bulletin SM-1. Literature shows various piping and valve arrangements for particular applications such as supply water to mill, emergency city connection, valves for liquid level control, emergency fire protection, spray valves for hot strip mills, coke quenching and drain valves, preventing flywheel explosion, other mill uses. *Golden-Anderson Valve Specialty Co., Dept. HPAC, 1210 Ridge Ave., Pittsburgh 33.*

▶ *VALVES*—Bulletin No. 357 describes line of chemical relief valves, back pressure valves. Four page literature gives specifications including capacities of standard ¼, ½, ¾, 1 in. sizes. Dimensions, materials of construction also included. *Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Ln., Philadelphia 18.*

▶ *VALVES*—Revised 43 page bulletin (V-203, Rev. 1) covers company's semi-steel valve line. Contains two pages of photographs, drawings, detailed description of lubricants and lubricating methods; large cutaway photographs showing working parts of two-bolt cover, screwed-gland, bolted-gland, multiport valve types. *Rockwell Mfg. Co., Meter and Valve Div., Dept. HPAC, 400 N. Lexington Ave., Pittsburgh 8.*

for peace of mind when the pressure is on . . .



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for all high-pressure installations

Full couplings and half couplings are available from stock for prompt shipment in all sizes from ⅛" through 4".

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HOW TO CUT APPLICATION COSTS

in Protecting Pipe and Pipe Joints Against Corrosion

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When specifications call for hot applied coal tar protection of underground piping as in AWWA specifications C-203 and C-204, and the volume does not justify the cost of shipment to a mill for coating—TAPECOAT offers a practical solution. Here is a widely-accepted alternate material that is equivalent to mill-applied hot coal tar protection.

With this coal tar coating in handy tape form, piping contractors can use their own personnel to do the job because technical know-how and special equipment are not required. You save time and money and eliminate the need for sub-contracting in assuring the long-life protection called for.

TAPECOAT is easy to apply, using a torch to soften and bleed the pitch which provides both bond and protection. Available in widths of 2″, 3″, 4″, 6″, 18″ and 24″, it is spirally wrapped or cigarette wrapped around the vulnerable surfaces.

Since 1941, TAPECOAT has proved its ability to fight corrosion on pipe, pipe joints, mechanical couplings, conduit, cable and insulated piping.

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The TAPECOAT® Company

Originators of Coal Tar Coating in Tape Form

1555 Lyons Street
Evanston, Illinois

RECENT TRADE LITERATURE

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▶ *VELOCITY METER*—New 20 page booklet explains how "Velometer" can be used for measuring air velocities in large open areas, at supply openings, at suction openings, or inside ducts. *Illinois Testing Laboratories, Inc., Dept. HPAC, 420 N. La Salle St., Chicago 10.*

▶ *WATER VAPOR RECORDER*—Continuous water vapor recorder for measuring low concentrations in streams of air or various gases for process industries, gas pipelines presented in bulletin No. 0714-1. Explains, illustrates principle of operation, which is based on measurement of heat energy exchanged when gas is adsorbed or desorbed from surface of solid adsorbent. *Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock Ave., Pittsburgh 8.*

▶ *WELDING EQUIPMENT*—Line of equipment for use in applications of company's tungsten arc "Heliweld" process illustrated in new 20 page catalog 2300. Advantages of process, factors which determine equipment selection discussed. Information on various types of manual, semi-automatic, automatic equipment and accessory devices included. *Air Reduction Sales Co., Div. of Air Reduction Co., Inc., Dept. HPAC, 150 E. 42nd St., New York 17.*

▶ *WELDING OUTLETS*—"Couplets"—branch connections for tanks, pressure vessels, pipelines—covered in new 4 page bulletin CP-1-57. Literature includes dimensional, specification data on screw-end, socket-welding, 90 deg elbow types. *W-S Fittings Div., H. K. Porter Co., Inc., Dept. HPAC, P. O. Box 95, Roselle, N. J.*

▶ *ZINC COATED STEEL*—"Weirkote" zinc coated steel covered in 12 page bulletin Literature illustrates, describes applications; cites uses in heating, ventilating, air conditioning. *Weirton Steel Co., Div. of National Steel Corp., Dept. HPAC, Weirton, W. Va.*

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Around St. Louis, C. H. Burnap, 312 Chouteau Bldg., is a well-known "executioner" of steam waste in schools and other buildings where boilers are used for steam heating.

He does it with SELECTOTHERM, the high-vacuum heating system that automatically provides steam at the proper pressure and temperature for perfect comfort. Installation records show that SELECTOTHERM cuts the fuel bill 19% or more—*enough to pay for the system within five years!*

SELECTOTHERM applies the control directly to the boiler, adds to the effectiveness of unit ventilators and individual room control. Get the whole story. If you're from the St. Louis area, call C. H. Burnap at The C. H. Burnap Co. (Jefferson 5-7992). If not, write for fact-filled SELECTOTHERM booklet, *Boiler Room Ballad.*

* *Mr. Entropy represents the heat that is produced but unavailable for use.*

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HEATING CONTROL SYSTEM ®

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WHO'S WHAT...

(New personnel, promotions)

▶ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE*—Officers elected at ARI annual meeting are: Lud Emde (president, Temprite Products Corp.), president; Don V. Petrone (president, Typhoon Air Conditioning Co., Div. of Hupp Corp.), vice president; Rudy Berg (vice president, Copeland Refrigeration Corp.), treasurer. Newly elected directors are: E. W. Ervasti, general sales manager, Calumet & Hecla of Canada, Ltd.; Russell Gray, vice president and general manager of Unitary Equipment Div., Carrier Corp.; H. F. Hildreth, manager, refrigeration specialties, Westinghouse Electric Corp.; L. N. Hunter, senior vice president of National-U.S. Radiator Corp.; B. E. James, executive vice president of McQuay, Inc.; F. E. Lehman, manager of commercial sales department, Frigidaire Div., General Motors Corp.; J. W. Norris, president, Lennox Industries, Inc.; Mr. Petrone.

▶ *AIRTEMP DIV., CHRYSLER CORP.*—Paul W. Wyckoff, director of all engineering activities. He has been chief engineer for the division.

▶ *NEW YORK UNIVERSITY*—Elmer R. Kaiser, senior engineering scientist in research division of College of Engineering.

▶ *DUNHAM-BUSH, INC.*—A. G. Zumbrun, Sr., vice president and director; G. C. Mumford, assistant treasurer; S. W. Mozley, a director.

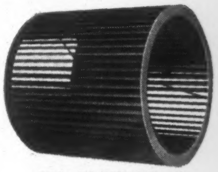
▶ *GAS APPLIANCE MANUFACTURER'S ASSOCIATION*—Officers elected at 22nd annual meeting include: Clifford V. Coons (executive vice president, Rheem Mfg. Co.), president; Edward A. Norman, Jr. (president, Norman Products Co.), first vice president.

▶ *STATE OF INDIANA*—J. Fred Keppler, director of Division of Industrial Hygiene, Indiana State Board of Health.

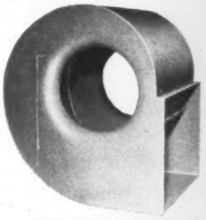
▶ *BORG-WARNER CORP.*—Robert W. Murphy, chairman of executive committee; George P. F. Smith, vice president; C. A. Barnes, assistant treasurer; Howard E. Morison, vice president of Ingersoll Steel Div.

▶ *FAIRBANKS, MORSE & CO.*—Robert H. Morse, III, vice president in charge of budgets and planning; V. H. Peterson, vice president in charge of sales; John A. Cuneo, vice president in charge of foreign operations; John C. Elmburg, general sales manager;

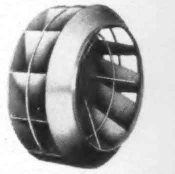
Make
BARRY
BLOWER COMPANY
your dependable low cost source of supply for
POWER FAN EQUIPMENT



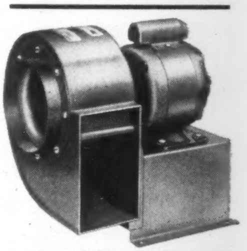
BFC, DI-DW Wheel



BFC, DI-DW Housing



BBI Blower Wheel SI-SW. Class 2.

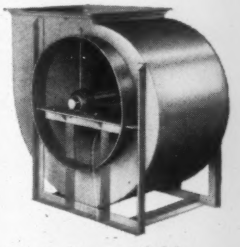


↑ Direct Drive, All-Purpose Utility Blower

We offer users of power fan equipment a full line of blowers, multiple blower assemblies, direct and belt driven ventilating sets, cast iron blowers and various types of centrifugal blower wheels and housings. All sizes from 6" to 73".

ALL BARRY blower wheels and housings are precision made from steel, aluminum, brass, copper or stainless, and are expertly balanced and trued before shipment.

We make power fan equipment *exclusively*, and do not compete with our own customers . . . . . and, we have a high reputation for dependable quality and remarkably fast deliveries. Let us quote on our standard equipment, or upon your special sizes and specifications. Write us today.



BBI Blower, SI-SW Arrangement No. 3, class 4 →

REPRESENTATIVES: A few territories available for sales representatives

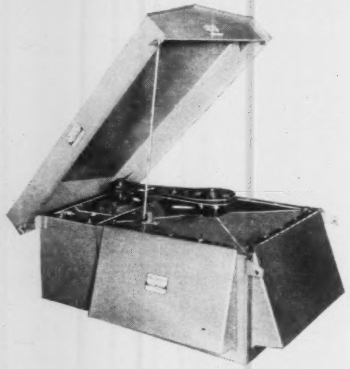
BARRY BLOWER CO.
3100 California Street N.E. • Minneapolis 18, Minnesota

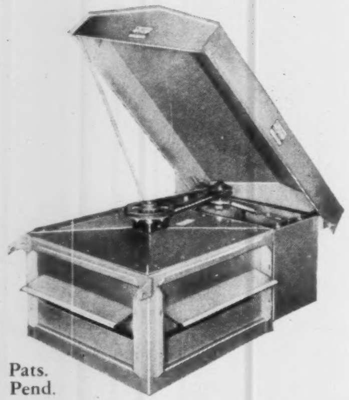
AirMpeler

LO-BOY

CENTRIFUGAL
ROOF EXHAUSTERS

Enchance The Beauty Of Building Skylines





Pats.
Pend.

Lowest Silhouette Design

Forward or Backward Curve Wheel Within . . . . or Out of Scroll Housing

Motor mounting on side of structure support . . . out of line of air stream reduces height of Lo-Boy models nearly 50% of older designs.

LOW WIND RESISTANCE
SIZES 10"-72" 600-47,000
CERTIFIED C.F.M. RATINGS

- QUALITY
- BEAUTY
- PROVEN PERFORMANCE

See Sweet's File 20c/Amm or Write for bulletin HA-100 57

AMMERMAN CO., INC.

110 North Second St.
Minneapolis 1, Minnesota
MEMBER OF THE AIR MOVING & CONDITIONING ASSN.

WHO'S WHAT

Continued

G. R. Anderson, Sr., chief engineer; C. E. Clausen, manager of Kansas City, Kan., plant; H. M. Goodchild, manager of St. Johnsbury, Vt., works; G. R. Anderson, Jr., chief engineer at St. Johnsbury.

▶ *BITUMINOUS COAL RESEARCH, INC.*—Dr. Charles E. Lawall, recipient of 1957 BCR annual award for outstanding leadership on behalf of industry sponsored coal research. Dr. Lawall is vice president of coal traffic and development of Chesapeake and Ohio Railway.

▶ *IRON FIREMAN MFG. CO.*—Lewis Cox, first vice president and a director.

▶ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—James C. Locke, manager of operations for Minneapolis Div. Commercial division appointments are: Ralph W. Crysler, manager of sales; Fred C. Brandt, manager of technical services; Jerome F. Cummiskey, assistant manager of sales. Mr. Brandt will be succeeded as manager of southwestern sales region by Robert L. Mallory.

▶ *OLIN MATHIESON CHEMICAL CORP.*—John M. Olin, chairman of financial and operating policy committee; Thomas S. Nichols, chairman of the board; Stanley de J. Osborne, president; John W. Hanes, financial consultant and member of financial and operating policy committee; R. Carter Dye, general sales manager for Olin Aluminum Div.

▶ *REFRIGERATION SERVICE ENGINEERS SOCIETY*—James M. McGrath, member of the International Educational and Examining Board of RSES. Mr. McGrath is a member of California State Polytechnic College's Air Conditioning and Refrigeration Engineering faculty.

QUIET

mechanical
equipment
operation
now possible
. . . roof to
basement . . .
by installing
on Korfund
Mounts

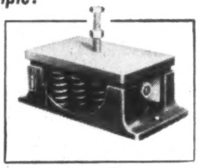
Heavy fans, pumps, compressors and other equipment mounted on Korfund vibration and noise control mounts run smooth and quiet. Machinery installations can be made anywhere in a building without fear of annoyances. Whether you're planning to install new mechanical equipment, or are troubled by your present system it will pay you to call Korfund.

Korfund offers a complete line utilizing springs - rubber - cork alone or in combination . . .

For Example:

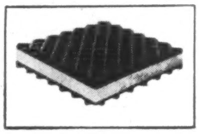
Vibro-Isolators

For Critical Installations. Spring assembly floats vibrating equipment, stops vibration and noise transmission. Satisfaction guaranteed.



Elasto-Rib

For non-critical installations. Multi-purpose cushion dampens noise, economically checks vibration.



Bulletin No. 48 describes the Korfund line and tabulates isolation requirements for different types of equipment and building conditions. Yours for the asking—write today.

THE KORFUND COMPANY, INC.
KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK
48-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

WHO'S WHAT

Continued

- *AMERICAN COILS CO.*—Frederick G. Riedel, chief engineer.

- *NATIONAL-U. S. RADIATOR CORP.*—Lt. Col. John L. Morrison, educational director of company's recently inaugurated air conditioning school.

- *INTERNATIONAL NICKEL CO., INC.*—O. B. J. Fraser, awarded honorary membership in American Welding Society. Mr. Fraser is assistant manager of the company's development and research division.

- *CENTRAL FUEL CO.*—Kal Steiner, vice president and manager, Baltimore sales and services.

- *BABCOCK & WILCOX CO.*—J. E. Brinckerhoff, a vice president; James S. Anderson, vice president of the company in charge of sales for Tubular Products Div.; Vincent R. Barrord, manager of development sales for welded tubing, Tubular Products Div.

- *COPELAND REFRIGERATION CORP.*—Merle W. McLaughlin, vice president in charge of manufacturing.

- *LANCASTER PUMP & MFG. CO., INC.*—Paul Carpenter, general sales manager, succeeding H. L. Frensdorf, retired.

- *FEDDERS-QUIGAN CORP.*—G. E. LaPorte, assistant director of engineering.

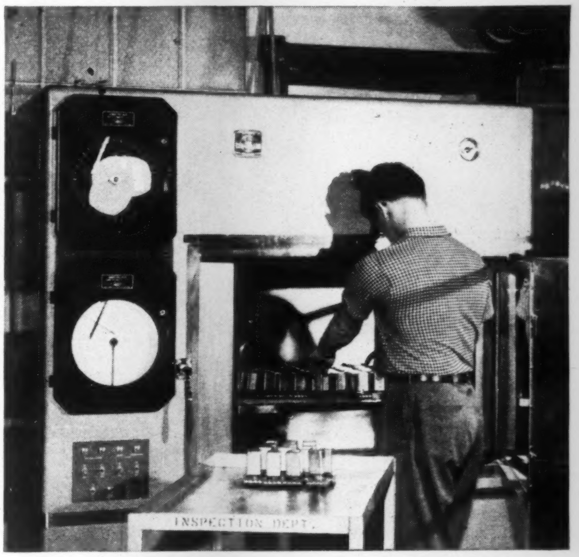
- *BLAW-KNOX CO.*—George M. Keen, manager of sprinkler department, Power Piping & Sprinkler Div.

- *WESTINGHOUSE ELECTRIC CORP.*—John C. Feick, Jr., assistant to vice president in charge of air conditioning division.

- *RAMSET FASTENING SYSTEM, OLIN MATHIESON CHEMICAL CORP.*—Daniel H. Moller, field sales manager; Rowland J. Kopf, special projects manager; R. H. Benedict, Jr., manager of sales training department; John W. Parsons, manager of kiln gun sales.

- *AMERICAN GILSONITE CO.*—Roy E. Nelson, vice president. Mr. Nelson will continue as manager of production for the company.

Taylor controls Weather made by "Climate-Lab!"*



Both humidity and temperature are precisely controlled in the "Climate-Lab" test apparatus, developed and marketed by the American Instrument Company, Silver Spring, Md. The control system employs a Taylor Time Schedule Double Duty Recording Controller, whose control settings are varied automatically by shaped cams to produce various time, temperature and humidity programs. It also provides a minute-by-minute chart record.

This apparatus is equally adaptable to research, development or production. Among its many applications are: testing various types of equipment and containers; checking products destined for government use to insure compliance with specifications; testing packaging of food and other products for resistance to or retention of moisture; atmospheric corrosion studies; research on the effects of climatic conditions on seeds, plants, animals, etc.

Taylor has the instrumentation and the know-how to provide the answer to many tricky problems in the field of air-conditioning. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

*TRADE MARK PENDING

Taylor Instruments
MEAN ACCURACY FIRST

WHO'S WHAT

Continued

▶ *FRANKLIN INSTITUTE LABORATORIES FOR RESEARCH AND DEVELOPMENT*—Frederick S. Burrell, chief of engineering mechanics section of mechanical engineering division.

▶ *HAYS CORP.*—Philip A. Sprague, president; Donald R. Schoen, executive vice president.

▶ *TUBE TURNS, DIV. OF NATIONAL CYLINDER GAS CO.*—Louis Norheimer, treasurer pro tem of American Production and Inventory Control Society. Mr. Norheimer is production control manager of Tube Turns.

▶ *HOOKER ELECTROCHEMICAL CO.*—Frank W. Dennis, a director and vice president.

▶ *MARLEY CO.*—F. B. Reed, a vice president and general sales manager; Lyle A. Christensen, director of sales and advertising; John H. Bateman, president of Marley International, Inc. and Marley Pan American, Inc., the company's export sales subsidiaries.

▶ *AIR-D-LUX CORP.*—Philip D. Grossman, sales manager.

▶ *ROCKWELL MFG. CO.*—Herman Gottwald and Donald C. Morgan, assistant vice presidents and product managers of Meter and Valve Div. Robert A. Johnson succeeds Mr. Gottwald as eastern regional sales manager. Replacing Mr. Morgan as central regional sales manager is Thomas O. Carson.

▶ *WHEELABRATOR CORP.*—Kenneth E. Blessing, sales manager, dust and fume control division.

▶ *BAKELITE CO., DIV. OF UNION CARBIDE CORP.*—M. M. Suba, manager, extrusion materials division.

▶ *ROBERTSHAW-FULTON CONTROLS CO.*—For Fulton Sylphon Div.: Marvin G. Calhoun, supervisor of bellows sales division; J. H. Fielden, applications engineer. For Acro Div.: William Ohly manager of distributor sales.

▶ *THOR POWER TOOL CO.*—James A. Lind, vice president, finance; John F. Corkery, vice president, public relations.

Cool as a Cumulus
SHREVEPORTER
HOTEL
SWIMMING POOL
DINING TERRACE
Quiet Beyond Belief!
d-h AIR CONDITIONING

Says: Jack Tullos, President-Manager of the eye-filling new Shreveporter Highway Hotel . . .

- "Quite a saving in initial and operating costs!"
- "Periodic filter change our only maintenance."

Drayer-Hanson can cite similar case histories, world-wide: big jobs or small; new or old construction; residential, commercial, industrial . . .

Request SPOTAIRE literature

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DIVISION OF NATIONAL-U.S. RADIATOR CORP.
3301 MEDFORD STREET
LOS ANGELES 63, CALIFORNIA
CABLE FORTRADE

WHO'S WHAT

Continued

▶ *HOWELL ELECTRIC MOTORS CO.*—Robert A. Hamilton, assistant to president.

▶ *OWENS-CORNING FIBERGLAS CORP.*— L. E. Cover, consultant to company's appliance and equipment products division.

▶ *KENCO PUMP DIV.*—James G. Huiett, sales manager.

▶ *KURZ & ROOT CO.*—Eli Chappe, vice president in charge of commercial sales.

▶ *NATIONAL SUPPLY CO.*—M. E. Swaim, vice president, sales.

▶ *FLEXIBLE TUBING CORP.*—Eugene G. Swartz, vice president in charge of administration and finance; Charles E. Smith, factory manager.

▶ *HUPPOWER DIV., HUPP CORP.*—Robert L. Plasco, sales engineer.

▶ *U. S. GAUGE DIV., AMERICAN MACHINE AND METALS, INC.*—Joseph A. E. Hindman, sales manager.

▶ *RUSSELL, BURDSALL & WARD BOLT AND NUT CO.*—Robert McNeal Smith, assistant vice president of sales.

▶ *EMERSON ELECTRIC MFG. CO.*—Gilbert F. Craig, vice president in charge of industrial relations.

▶ *BORG-WARNER CORP.*—William M. Valiant, assistant treasurer.

▶ *UNISTRUT PRODUCTS CO.*—Clem Kopf, manager of distributor organization, Unistrut Philadelphia.

▶ *YARDLEY PLASTICS CO.*—William R. Hite, manager of sales promotion.

▶ *BENDIX AVIATION CORP.*—M. J. Kennedy, assistant general manager of Skinner Div.

you can depend on
AGITAIR for better air

Custom Made

AIR DIFFUSERS with DIFFUSING VANES

Each AGITAIR square and rectangular air diffuser is custom designed to meet your requirements of air flow and interior treatment.

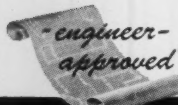
These AGITAIR diffusers have built-in diffusing vanes, scientifically arranged in unlimited louver patterns to provide certified 100% draftless air distribution from any ceiling or wall location.

AGITAIR Catalog R-107 shows you how to select the proper size and pattern for your job conditions.

Write for your copy today.

AIR DEVICES INC.
185 MADISON AVE., N. Y. 16, N. Y.
air diffusers • filters • exhausters

put **Extra-Profits** *in your pocket* **with**



ELGEN *All-Tite* VANE RUNNERS NOW IN COILS!

OPEN THIS END
PULL HERE THIS END UP USE NO HOOKS
Save Time and Money... with ELGEN 'All-Tite' VANE RUNNERS

THE EASIEST AND QUICKEST WAY EVER DEVISED

for installing single or double blade turning vanes in square elbows. No special tools required.

New production machinery of our own exclusive design, now enables us to produce button type Elgen All-Tite vane runners in continuous coils, effecting a savings in *your cost per job.*

COILED ELGEN ALL-TITE VANE RUNNERS MEANS . . .

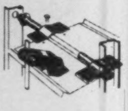
- *Less Waste!* Waste pieces due to short ends are a thing of the past. Vane runner metal is coiled in 100 foot lengths, you just pull out the exact footage needed.
- *Easier Storage!* Each coil weighs approximately 50 lbs. and is packed in a box 28" x 28" x 5". Box fits easily under bench or against wall.
- *Easier Handling!* No loose pieces lying around to get in the way or collect dirt.
- *Unrolls absolutely flat!* Vane runner metal emerges from the box at bench height . . . absolutely flat . . . ready for use.

TWO MORE ENGINEER-APPROVED ELGEN PRODUCTS THAT SAVE YOU TIME AND MONEY

ELGEN SILENT DUCT

. . . for forming "flexible" duct connectors. A one piece metal to material unit, packed in coils, unrolls absolutely flat. Makes on the spot work a cinch.

ELGEN DAMPERSET



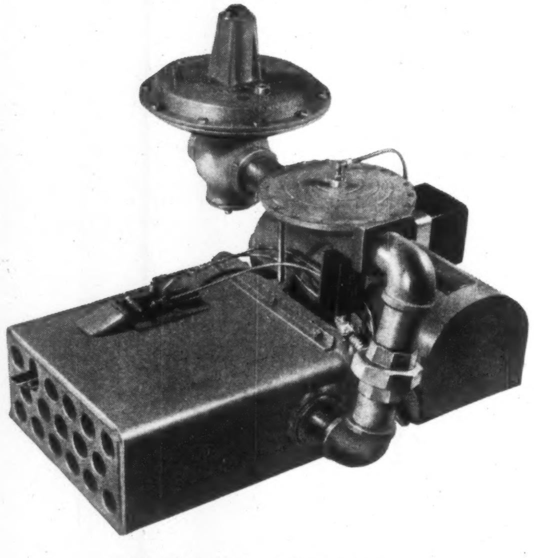
. . . for multi-blade dampers, parallel or opposed. Most perfect damper hardware developed.

ELGEN PRODUCTS ARE SOLD THROUGH LEADING JOBBERS EVERYWHERE.

Write today for free catalog and "spec" sheet!

ELGEN MANUFACTURING CORP.
41-34 39th Street, Long Island City 4, N. Y.

WHAT! NO STANDBY LOSS?



THAT'S RIGHT—

LO-BLAST

POWER-GAS BURNER

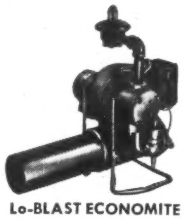
ELIMINATES THE FUEL WASTE CAUSED BY UNCONTROLLED DRAFT

When an atmospheric gas burner shuts off, the rush of draft air through the boiler or furnace carries heat with it up the chimney. . . causing a serious waste of fuel.

Since a burner is turned on and off several times an hour by the thermostat, a typical heating plant operates only about 2,000 hours of a 6,000 hour heating season. Hence, with an ordinary burner, "standby loss" occurs two-thirds of the time.

In contrast, the Lo-BLAST Power Gas Burner does not depend upon natural draft, but upon air supplied by a small, *quiet* blower. It provides combustion air *only when the burner is on!* When the burner shuts off, only enough air for pilot combustion is admitted. The heating plant retains much of its heat between operating cycles.

That's why Lo-BLAST Burners average 10% less in operating cost. Capacities of 75,000 to 20,000,000 BTU give complete coverage of residential, commercial and industrial fields.



Lo-BLAST ECONOMITE

The residential Lo-BLAST Burner—capacities 75,000—500,000 BTU.

Send today for complete information on the Lo-BLAST Power Gas Burner

MID-CONTINENT
METAL PRODUCTS CO.
1960 N. Clybourn Ave., Chicago 14, Ill.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *BUENSOD-STACEY, INC.*—H. L. McMurry & Co., representative for dual-duct air conditioning equipment in Florida.

▶ *D. J. MURRAY MFG. CO.*—Appointed distributors and the territories they will cover are: W. H. Bintz, Utah, 20 counties in Montana, 15 counties in Wyoming, three counties in Colorado, four counties in Nevada; Mechanical Associates, Georgia.

▶ *J. F. PRITCHARD & CO. OF CALIFORNIA*—Steel and Engineering Products Co., representative for New Mexico, western tip of Texas.

▶ *CLEAVER-BROOKS CO.*—Norbert W. Enslen Co., representative for boiler equipment in Dayton, Ohio, area.

▶ *ALLIS-CHALMERS MFG. CO.*—Appointments for Pittsburgh district office of company's Industries Group are: John H. Baisley, manager, metals industry sales; E. E. Ellis, manager, general industrial sales; L. H. Walke, manager, utility sales.

▶ *A. M. BYERS CO.*—Stevens Supply Corp., distributor of wrought iron pipe in Radford, Va., area.

▶ *LIMA REGISTER CO.*—Al Jevons, sales representative with headquarters in Feeding Hills, Mass.; Charles E. Rihl, district sales representative in Philadelphia territory.

▶ *SPORLAN VALVE CO.*—Harold S. Jordan, to assist P. J. McCarty, head of company's Los Angeles office, in covering southern California, Arizona.

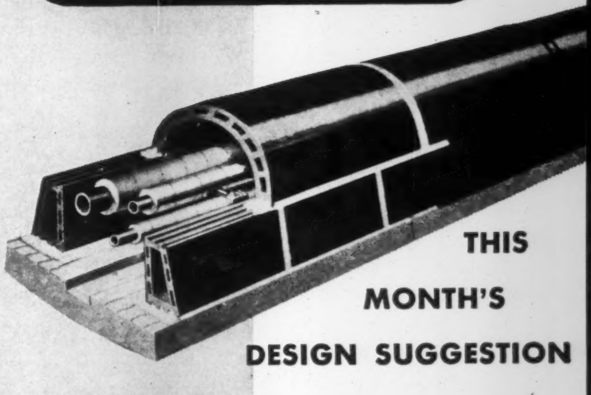
▶ *DUNHAM-BUSH, INC.*—Dean Keuch, sales engineer, transferred to Cleveland area.

▶ *DRAYER-HANSON, DIV. OF NATIONAL-U.S. RADIATOR CORP.*—Midgley-Huber, sales agent for Utah, Idaho.

▶ *L. J. WING MFG. CO.*—McCotter and Sons Co., representative for eastern Wisconsin.

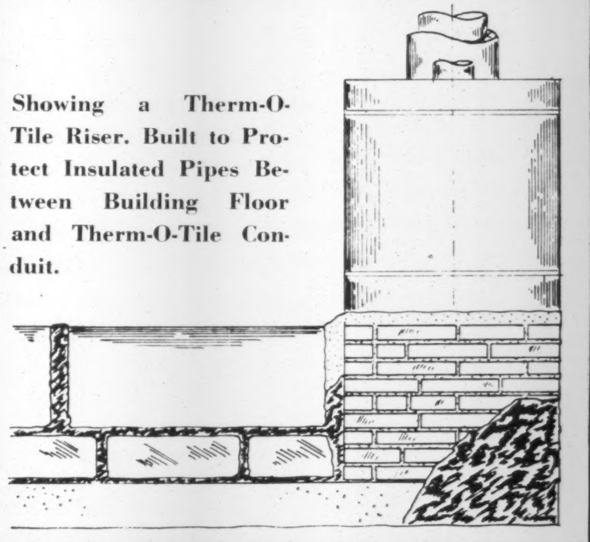
Therm-O-Tile
CONDUIT
FOR
UNDERGROUND
PIPING

• PERMANENT • ECONOMICAL
• SIMPLE • EFFICIENT



THIS
MONTH'S
DESIGN SUGGESTION

How to Build a
Therm-O-Tile Riser



Showing a Therm-O-Tile Riser. Built to Protect Insulated Pipes Between Building Floor and Therm-O-Tile Conduit.

FOR ADDITIONAL DESIGN DETAILS
AND GENERAL INFORMATION ASK FOR
Bulletin No. 9156

H. W. PORTER & CO., INC. • REID HAYDEN, INC.
822 Frelinghuysen Ave., Newark, N. J.
Baltimore, Md. Richmond, Va. Charlotte, N. C.
Insulation Engineers and Contractors

WHO'S WHAT

Continued

▶ *WORTHINGTON CORP.*—Cahn Electric Co., Inc., wholesaler of air conditioning equipment in northern Louisiana, southern Arkansas areas.

▶ *JOHNS-MANVILLE CORP.*—Jack W. Davis, regional sales manager for pipe division, Rocky Mountain region.

▶ *RECOLD CORP.*—Tri-State Equipment Co., distributor in Preakness, N.J., area.

▶ *IRON FIREMAN MFG. CO.*—Hyter C. Hall, Jr., district sales manager for Philadelphia, Washington, D.C., Baltimore areas; W. Oliver Spencer, Jr., industrial sales representative in the Carolinas, Virginia, West Virginia.

▶ *TRANE CO.*—Florida Weathermakers, Inc., authorized source for Trane products in Jacksonville area. Self contained air conditioner sales representatives and their assignments are: William C. Laughlin, Houston; Edward P. Ouellette, Boston; William J. Yutz, Louisville.

▶ *SLANT-FIN RADIATOR CORP.*—George Garbowit, direct factory sales engineer for Baltimore-Washington area.

▶ *REMINGTON AIR CONDITIONING DIV., REMINGTON CORP.*—Harry G. Duval, Virginia representative.

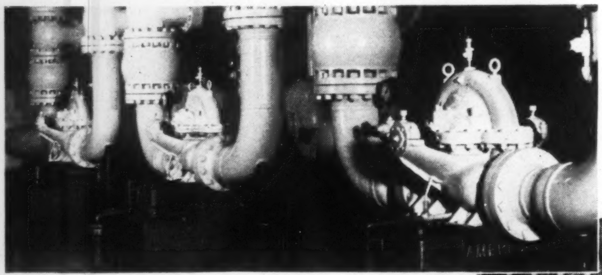
▶ *SHAW-PERKINS MFG. CO.*—J. W. Miller, Jr., district sales representative in central New York area.

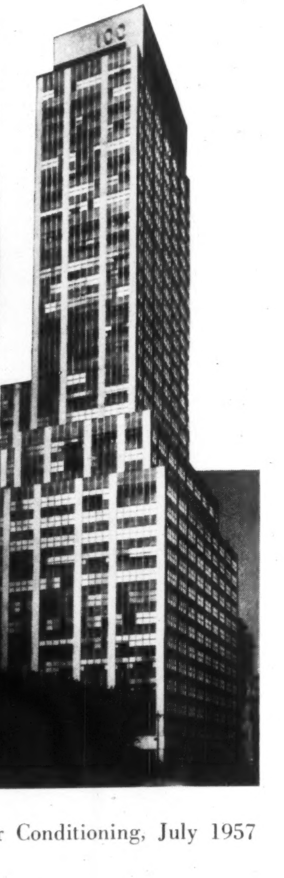
▶ *MAID-O'-MIST, INC.*—Named representatives are: L. J. Rathbun, Illinois; C. Victor Hanson, Iowa, Nebraska.

▶ *BARNEBEY-CHENEY CO.*—Representatives for "PurAir" activated charcoal air purification equipment are: R. E. Chase and Co., Inc., Washington State, west of Columbia River; Technical Service Co., New Mexico; E. H. Henderson, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland.

▶ *REFLECTAL CORP.*—Appointed product field representatives are: Stuart A. Helffrich, southeastern territory; Walter R. Lewis, Cleveland territory, succeeding O. B. Thomas, who has taken over as Re-

100 Park Avenue *KEEPS COOL* with AMERICAN-MARSH PUMPS





To circulate chilled water in the air conditioning system, these American-Marsh Pumps are used in the 100 Park Avenue Building, New York City. Bronze fitted and directly connected to 150 HP motors, they have a capacity of 2,000 GPM.

In almost continuous operation for about three years, they have performed their vital job with excellent satisfaction. American-Marsh can satisfy your pumping needs, too.

WRITE FOR DETAILS
stating size and type of pumps that interest you most.

AMERICAN-MARSH PUMPS
BATTLE CREEK MICHIGAN
In Canada:
American-Marsh Pumps (Canada) Ltd., Stratford, Ont.

NEW
permanent
dry-type
A-Lum-O-Aire
Copper
UL

FILTERS...

designed for industrial air-cleaning requirements

RESISTS RUST and CORROSION

Impervious to hazardous industrial atmospheres, new A-LUM-O-AIRE COPPER Filters are the practical solution for handling corrosion and moisture-laden fumes, vapors and gases. Copper wool, used as the filter media, is manufactured by Carey to precision standards from special alloys developed expressly for air cleaning. Mat retainers are copper plated for longer life with added protection against rusting and corrosion.

QUICKLY CLEANED for CONTINUOUS USE

Simply flush A-LUM-O-AIRE COPPER Filters with water or solvent and replace. No hazardous oils to add; no messy adhesives required. END pyramiding filter replacement costs NOW with the filter designed for the rugged demands of industry. Available in standard and high-velocity types for normal resistance or engineered to your specific size and capacity requirements.

America's *first* practical recleanable all-metal, dry-type air filter! Approved by Underwriters (Class 1)!

A-Lum-O-Aire

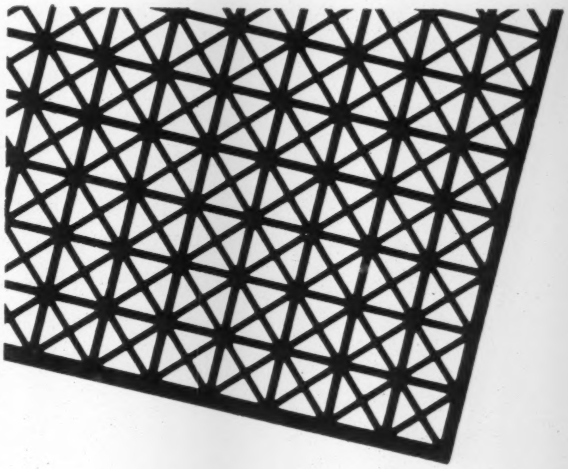
MAIL THIS COUPON TODAY

Carey Electronic Engineering Co.
Metal Wool Division
1880 Clifton Avenue
Springfield, Ohio

☐ send folder
☐ we're sending data for quote

Tell me more—
about your new A-LUM-O-AIRE Filters and show me how we can save money on our air-cleaning activities.

Name________ Title________
Company________
Address________
City________ Zone____ State____



THEY'RE ELEGANT ...THEY'RE ECONOMICAL

Hendrick Architectural Grilles

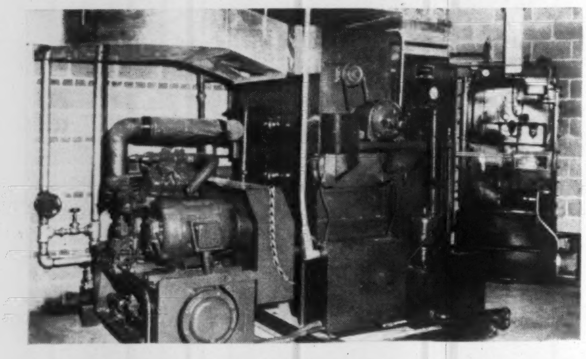
When an architect draws up specifications for a new building or a modernization proposal he must adhere to two basic principles: FIRST, he must use his head in keeping costs down. SECOND, he must recommend functional materials and components that appeal to his client's decorative motif and sense of beauty. That's why more and more architects specify Hendrick Grilles. Available in hundreds of attractive designs, Hendrick Grilles cost less to buy . . . cost less to install and cost less to maintain! And they provide more-than-ample area for free passage of air . . . always lie flat . . . don't bend or warp. For more information write to Hendrick, today.

HENDRICK
MANUFACTURING COMPANY
48 DUNDAFF STREET CARBONDALE, PA.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles Mitco Open Steel Flooring — Shur-Site Treads • Armorgrids Hydro Dehazers • Petrochemical Column Internals

#625

DRY AIR...
PRECISELY as you want it



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

Write for full information; ask for Bulletins 112 and 121. Address Dept. HP-7

NIAGARA BLOWER COMPANY
405 Lexington Ave., New York 17, N. Y.
District Engineers in Principal Cities of U.S. and Canada

WHO'S WHAT

Continued

flectal's central sales manager; David A. Milne, northeastern territory.

▶ *KOCH ENGINEERING CO.*—Representatives for "Jet" forced draft cooling towers are: Engineering Sales Co., New Orleans; The Sales Engineers, Minneapolis; Bishop Heating and Supply, Highland Park, Ill.; Harry Alter Co., Chicago; Harry Hadley & Assoc., Marietta, Ohio; H. E. Culley & Co., Louisville; Loeffler-Greene Supply Co., Oklahoma City; Heaven Engineering Co., Kansas City, Mo.; General Power Equipment Co., Dallas; Alfred H. Hamilton, Chicago; Great Lakes Air Conditioning Co., Detroit; Ralph Simmons, Buffalo; Boulder Parts Corp., Green Bay, Wis.; Sanford Mechanical Equipment Co., Inc., Oakland; R. T. Andrews, Sacramento; Dave Masters, Fresno, Calif.; Roy Huemoeller, Santa Clara, Calif.; Olesko & Fisher, Rensselaer, N.Y.; Smallwood Equipment Sales, Toronto, Can.

▶ *MUELLER CLIMATROL*—George D. Wookey, regional sales manager for California, Arizona, Nevada.

▶ *JOHNSON SERVICE CO.*—Robert H. Anderson, manager of Youngstown branch; Edwin A. Smith, a similar appointment for Pittsburgh branch, succeeding Fabian C. McIntosh, retired.

▶ *FLEXONICS CORP.*—Robert F. Barge, sales engineer for Lake Erie-St. Lawrence area.

▶ *AMERICAN BLOWER DIV. OF AMERICAN-STANDARD*—W. G. Harward, manager of newly established branch sales engineering office in Miami.

▶ *PHELPS DODGE COPPER PRODUCTS CORP.*—Richard I. Wilson, Philadelphia district manager.

▶ *RESEARCH PRODUCTS CORP.*—Western Sales Service, representative for Colorado, Utah, Wyoming, Montana, southern Idaho.

▶ *MARLO COIL CO.*—Dale Weitman & Co., representative for Beloit, Wis., area. Marlo has relocated its New York regional office to 122 E. 42nd St.

▶ *SHAW-PERKINS MFG. CO.*—George B. Wilson, representative for Baltimore, surrounding area.

▶ *CENTURY ELECTRIC CO.*—Donald R. Vick, head of new branch office in Portland, Ore.

Meet the CHALLENGE of CRITICAL SUCTION CONDITIONS

with the

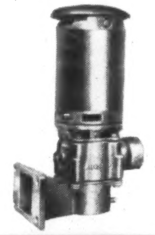
LOW NET SUCTION POSITIVE HEAD CHARACTERISTICS

of

AURORA®

CLOSE-COUPLED *TYPE B* CENTRIFUGAL GENERAL PURPOSE PUMPS

Modern industry is confronted more and more with critical suction conditions arising from hot water and chemical handling. These extremely high efficiency, compact, flexible and low NPSH pumps are a welcome answer. You'll be glad to get the facts.



TYPE BJF FLANGE MOUNTED

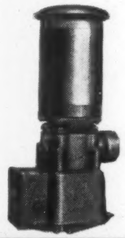
IDEAL *for* THESE DUTIES

AIR CONDITIONING
REFRIGERATION
COOLANT
HOT WATER
CHEMICAL*
GENERAL PURPOSE

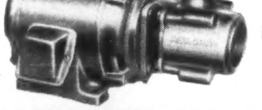
*MAY BE FURNISHED IN SPECIAL ALLOYS TO MEET SPECIFIC CONDITIONS

MANY VALUE FEATURES

SEAL or GLANDS — Available in either as desired.
SPEEDS — 3,500, 1,750 (60 cycle) and 2,880, 1,440 (50 cycle) speeds.
CURRENT — AC or DC — All voltages and phases.
MOTORS—1/6 to 7½ H.P. drip-proof, splash-proof, totally enclosed, explosion-proof and chemical. Quiet, efficient NEMA standard.
COMPACT — QUIET — ECONOMICAL.
ALSO AVAILABLE — in Type BJP Pedestal Mounted.



TYPE BJV BASE MOUNTED



TYPE BJH HORIZONTAL

WRITE FOR BULLETIN 119J

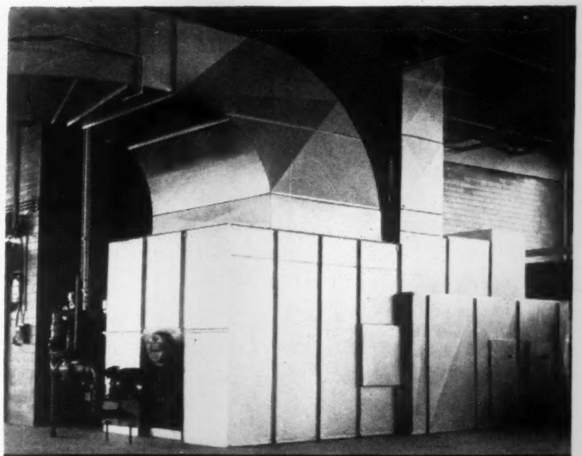
PUMPS *"by Aurora"*
for EVERY NEED in INDUSTRY
WATER SUPPLY
CONDENSATE
BOILER FEED
PROCESSING
BOOSTER
TRANSFER
ETC., ETC.,
Ask for CATALOG "M"

CONSULT WITH US

Aurora engineers will appreciate specifications of your difficult jobs. Only the RIGHT pump does the job RIGHT.

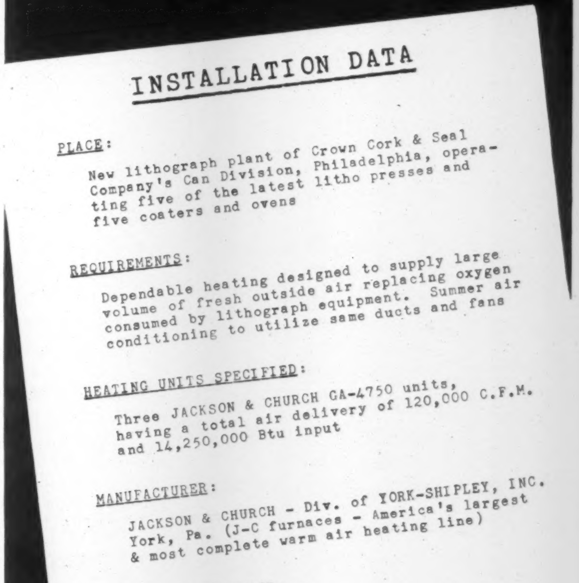
Your Inquiries Will Receive Prompt Attention
DISTRIBUTORS IN PRINCIPAL CITIES

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
80 LOUCKS STREET • AURORA • ILLINOIS
EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "AURORAPUMP"



Jackson & Church furnaces

solve difficult heating problems of new Crown Cork and Seal plant —



INSTALLATION DATA

PLACE:
New lithograph plant of Crown Cork & Seal Company's Can Division, Philadelphia, operating five of the latest litho presses and five coaters and ovens

REQUIREMENTS:
Dependable heating designed to supply large volume of fresh outside air replacing oxygen consumed by lithograph equipment. Summer air conditioning to utilize same ducts and fans

HEATING UNITS SPECIFIED:
Three JACKSON & CHURCH GA-4750 units, having a total air delivery of 120,000 C.F.M. and 14,250,000 Btu input

MANUFACTURER:
JACKSON & CHURCH - Div. of YORK-SHIPLEY, INC. York, Pa. (J-C furnaces - America's largest & most complete warm air heating line)

DISTRIBUTOR:
Furnace Distributors, Inc.
Philadelphia, Pa.

INSTALLER: Consolidated Air Conditioning

Modern facade' of Crown Cork & Seal Company's new plant in Philadelphia.

J-C

JACKSON & CHURCH
Division of
YORK-SHIPLEY, INC.
P.O. BOX 349, YORK, PENNSYLVANIA

WHO'S WHAT

Continued

▶ *ARMSTRONG CORK CO.*—Reassignments of insulation division sales representatives are: Emmett W. Hines, Syracuse; Donald R. Herb, Madison, Wis.; William O. Daily, Boston; Clifford D. Spaid, Toledo. For company's insulation contract service, named construction superintendents are: Burrell E. Carney, Houston; Robert G. Sindelar, Atlanta.

▶ *BABCOCK & WILCOX CO.*—J. Y. McCandless, manager of Syracuse district sales office of Tubular Products Div.

▶ *DRAVO CORP.*—F. E. Tapy, distributor for territory including 66 Nebraska, seven Iowa counties.

▶ *BUENSOD-STACEY, INC.*—Representatives for company's dual-duct air conditioning equipment are: Laurence Trant & Co., Norfolk and Richmond; Lancaster May & Co., Baltimore and Washington; Glassner Equipment Co., Pittsburgh.

▶ *DUNHAM-BUSH, INC.*—Frank Carryl, manager of new southeastern district office in Atlanta; Charles F. Cox, a similar appointment for new middle southern states district office in Birmingham; Maxwell G. Finke and Edward Albin, sales engineers for Milwaukee and St. Louis areas, respectively.

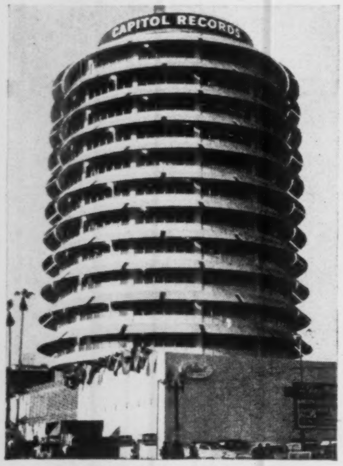
▶ *YORK CORP.*—Providence Electric Co., Inc., distributor for Providence, R.I., area.

▶ *WOLVERINE TUBE, DIV. OF CALUMET & HECLA, INC.*—George E. Reade, Chicago area representative.

▶ *ALLIS-CHALMERS MFG. CO.*—For Industries Group: Thomas W. Metz, manager of Mid-Atlantic region; John L. Wiedley, manager of Indianapolis district succeeding Mr. Metz; W. M. O'Connor, manager of Amarillo, Texas, district.

▶ *HAMMOND BRASS WORKS*—Eugene Zaleski, industrial sales representative for Great Lakes region.

▶ *ELECTROMODE DIV., COMMERCIAL CONTROLS CORP.*—Continuing to serve as representatives in northeast are: Macdonald-Wadman Co., New England; Neuburg Sales Service, eastern New York State, Pennsylvania, Washington, D.C. Earlier, it was incorrectly reported that another firm was to represent the company in that area. ✢



CAPITOL RECORDS BLDG.
LOS ANGELES, CAL.

WELTON, BECKET & ASSOCIATES, ARCHITECTS-ENGINEERS, STATE PLUMBING & HEATING CO., MECHANICAL CONTRACTOR

Capitalize on

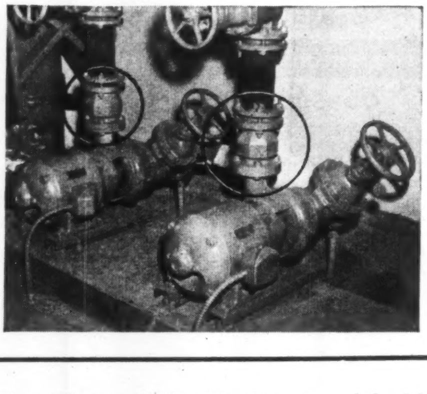
MILLER Streamflow CHECK VALVES

Completely Silences your piping system! CENTER-GUIDED, SHOCK PROOF, NOISELESS, ELIMINATES WATER HAMMER. FULL RADIAL FLOW.

SIZES 1" THROUGH 24".

FLANGED, ASA DRILLING, IBBM, CAST STEEL, ALL ALLOYS. FOR ALL FLUIDS AND GASES.

CERTIFIED MINIMUM PRESSURE DROP CURVE AVAILABLE



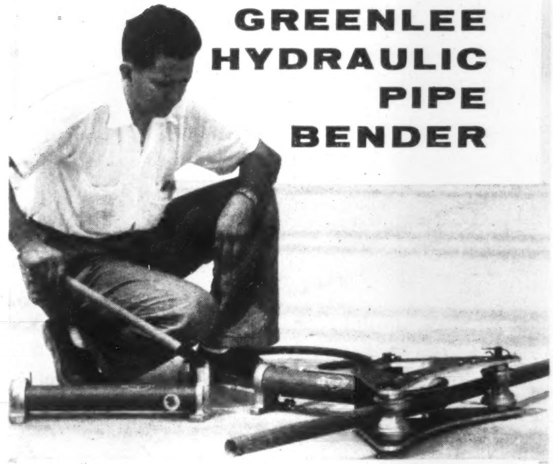
Write for literature • Agents in Principal Cities

MILLER VALVE CO., INC.

P.O. Box 1255—Pittsburgh 30, Pa. Plant—1620 Pennsylvania Ave.

save time, cut costs on your piping installations with lightweight, portable

GREENLEE HYDRAULIC PIPE BENDER

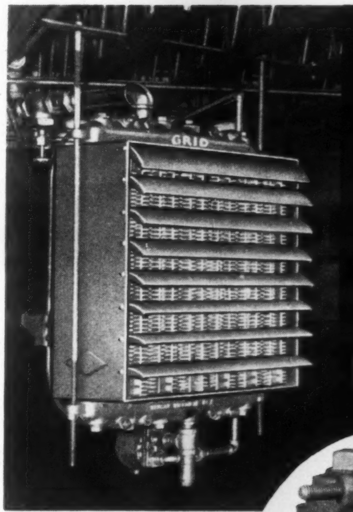


easy, fast operation makes 90° bend with one ram stroke

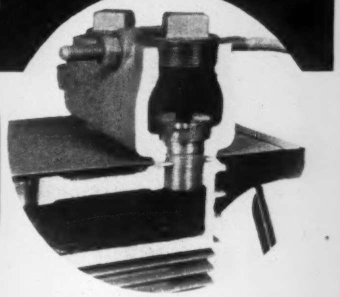
Quickly produce your own bends in cold pipe *right on the job* . . . exactly the way you want them, to make a correct-working, neat-fitting installation. Save hours of time, save labor, eliminate cost of many manufactured bends and fittings with the GREENLEE No. 880 Hydraulic Bender for ½" to 2" pipe. Easily carried and operated by *one man*. Accurate . . . makes bends to just the angle required. Fast . . . *a complete 90° bend made with one ram stroke.* Radius attachment also available for making radiant heating 180° return bends in tubing and pipe. Powerful . . . 15 tons of ram force! Easily operated by hand, or may be teamed with a GREENLEE power pump for production-line bending either in your shop or out on the job. GREENLEE line also includes larger hydraulic benders for pipe up to 5" and hand benders for tubing and small pipe. Get the complete story on how you can speed your work, make better installations, and cut job costs with a GREENLEE Bender. Write for folder E-221.

TOOLS FOR CRAFTSMEN
GREENLEE

GREENLEE TOOL CO.
2347 12th Street, Rockford, Illinois



HERE.. is your answer to UNIT HEATER problems!

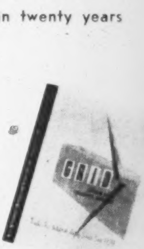


GRID

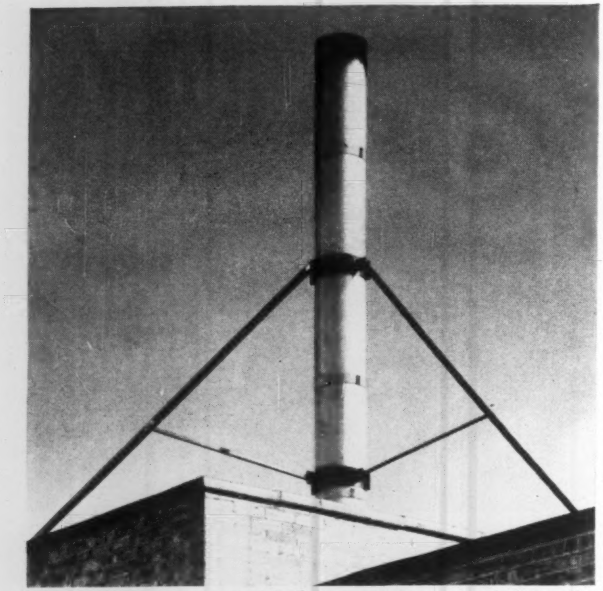
CAST IRON STEAM HEAT TRANSFER SURFACE

Your answer to unit heater problems industry has discovered through common failures of copper, aluminum and steel tube heat transfer surface. GRID condenser eliminates internal electrolytic corrosion—because all metals in contact with steam are similar. GRID also eliminates external corrosion—because the cast iron construction resists acid or other fumes in the air and eliminates the use of reducing valves where high steam pressure is used. GRID cast iron construction is tested to withstand steam pressures up to 250 P.S.I. . . . 450° temperature . . . no soldered, brazed, welded or expanded connections . . . a specially designed threaded nipple provides a leakproof joint. GRID eliminates the high maintenance costs generally experienced with other types of condenser construction . . . eliminates replacement costs because GRID is built to last for years . . . uninterrupted service records of more than twenty years are common among GRID users.

Send for the complete story on GRID Unit Heaters, GRID Blast Heaters and GRID Radiation for industrial plant use . . . it is contained in GRID Products Catalog No. 956. Write today for your copy.

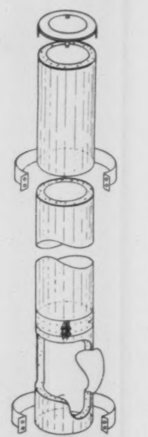


D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883 • WAUSAU, WISCONSIN
REPRESENTATIVES IN ALL PRINCIPAL CITIES



The Van-Packer is a cylindrical stack of 3-foot long centrifugally-cast refractory sections, cemented one on top of another and secured with draw-up joint bands. Sections are constructed of refractory material with aluminum outer jacket.

Van-Packer Refractory Stack provides permanence and high draft, costs 2/3rds less than brick stack



Low Cost — Factory-produced Van-Packer Stack costs an average of 2/3rds less than comparable brick stack, 1/2 less than comparable tile-lined concrete block stack, about the same as comparable steel stack.

Permanence—Refractory sections of Van-Packer Stack provide permanence of masonry, last an average of 3 times longer than steel.

High Draft—Tests prove Van-Packer Stack furnishes same high draft as comparable brick stack, substantially more draft than comparable steel stack, because insulated sections prevent excessive heat loss through stack walls.

No Maintenance—Aluminum jacket eliminates maintenance and requires no painting.

7 diameters from 10" I.D. to 30" I.D. in 2 types of stack sections: *Standard,* for flue gas temperatures up to 800°F. for continuous exposure and *Hi-Temp,* for flue gas temperatures up to 2000°F for continuous exposure. Van-Packer Stack handles all fuels; can be used for boilers, furnaces, incinerators.

Available nationwide through Van-Packer heating and building material jobbers, and manufacturers representatives. See "Chimneys — Prefabricated" in Yellow Pages, or write Van-Packer Company.

Sweet's

Send for 80-page data file with guying, installation method, test reports.

Van-Packer PREFABRICATED REFRACTORY Stack

Van-Packer Company • Division of The Flintkote Company
P. O. Box No. 306 • Bettendorf, Iowa • Phone: 5-2621

WE HEAR THAT . . .

▶ In dedication ceremonies held recently, *AIR REDUCTION CO., INC.* officially started production of liquid oxygen, nitrogen and argon at its new multi-million dollar air separation plant just completed in the Lake Calumet section of Chicago. The ceremony was preceded by a guided tour through the plant. Attending the affair were local city officials, executives from Chicago area firms and Air Reduction officials from New York and Chicago. The plant—designed to produce daily 55 tons of liquid oxygen, 15 tons of liquid nitrogen and 3½ tons of liquid argon—is the third large air separation facility completed by the company.

▶ Purchase of the furnace division of *JACKSON & CHURCH CO.* has been announced by *YORK-SHIPLEY, INC.* The purchase agreement covers all of the assets of the division, including designs, patents, trade marks, copyrights and franchise agreements for industrial and commercial warm air furnaces in capacities to 5 million Btu per hr.

▶ *SCOVILL MFG. CO.* helped celebrate the 250th anniversary of New Milford, Conn., recently, with the laying of the cornerstone for the company's new tube mill there. The building will contain 275,000 sq ft of manufacturing space and will be located on 72 acres of land.

▶ A new $1,250,000 technical design center—where *TRANE CO.* hopes to "uncover many of the answers to tomorrow's problems in weather comfort"—has been completed at La Crosse, Wis. The single-story, 65,000 sq ft, L-shaped building is located immediately adjacent to the company's research and testing laboratory.

▶ *JOSEPH T. RYERSON & SON, INC.* plans an expansion program at its Pittsburgh steel service plant which will increase capacity more than one-third. Construction will begin this year with completion scheduled for 1958. Cost of the building, machinery, and other operating equipment is estimated at $1 million.

▶ Full West Coast manufacturing operations have been established by *BRUNER CORP.* at 670 Gibbons St., Los Angeles. The new plant contains 15,000 sq ft of floor space.

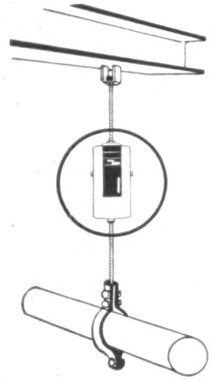
▶ A new educational and training presentation using audio-visual equipment is being made available on a loan basis from *SPORLAN VALVE CO.* It will be

"WITCH"

PIPE HANGERS

FOR

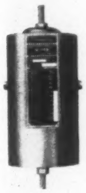
HEATING – PLUMBING POWER & PROCESS



- Rugged
- Compact
- Simple in design and installation
- Indispensable for systems operating at changing temperatures

FIG. 401

SPRING HANGER



Our catalogue illustrates a complete line of Pipe Hangers & Supports and is an indispensable reference book for engineers, contractors, estimators & erectors. Write for your copy now.

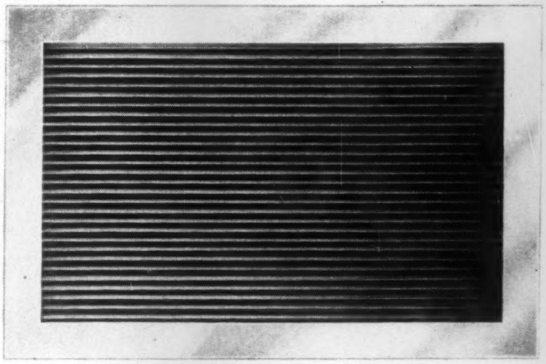
"WITCH"
PIPE HANGERS AND SUPPORTS

MAINTAINING OFFICES AND WAREHOUSES ACROSS THE NATION

CARPENTER and PATERSON, Inc.

18 HURLEY ST., CAMBRIDGE, MASS.

ALL NEW!
ALL ALUMINUM!
ALL EXCLUSIVE!



New A-J All-Aluminum No-Vision Grille

Another first in the field for A-J! This new extruded all-aluminum no-vision grille is the first of its kind . . . a grille that offers exclusive quality features never before available!

Imagine the beauty of this all-aluminum construction. Picture how its striking, modern look blends so perfectly with contemporary interior designs. Think of the ease of upkeep — corrosion and rust can never detract from its lifetime beauty. Because of the lightweight characteristics of aluminum, this new A-J Grille provides maximum free area (approximately 70%) with minimum weight.

The entire unit reflects quality in every detail of its construction. The extruded V-bars (of .044 aluminum) are spaced three to the inch, making the grille completely sight-proof. The "B" frame (.050 aluminum) has perfectly mitered corners which are securely fastened and locked mechanically — there's no surface blemish to mar its attractive appearance. Rims have countersunk screw holes for fastening to door or partition. Fastening screws are furnished with each unit. By utilizing an auxiliary frame (also of extruded aluminum) the grille span can be adjusted from 1¼" to 2⅛" in depth.

CHOICE OF FINISHES

Standard mill finish is provided unless otherwise specified. Anodized or polished finishes are available. If non-standard finishes are desired, please consult the factory for prices.

> NOTE: the new A-J Aluminum Grille is also available with an "A" style channel frame of .050 sheet aluminum. If ordered in this manner, installer provides molding or stops.

This new A-J Grille is produced in standard sizes. For more information write A-J Manufacturing Company, Dept. H-7, 3601 E. 18th St., Kansas City 27, Mo.

FREE CATALOG

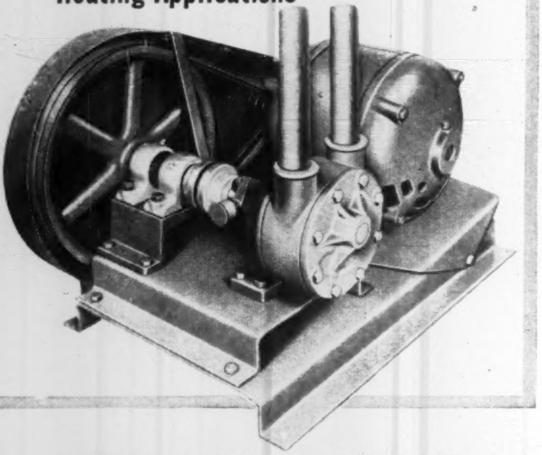
listing, describing and pricing 1,000 types and sizes of grilles, registers, etc.

A-J Manufacturing Co.

Dept. H-7 3601 E. 18th St., Kansas City 27, Mo.

new TUTHILL SU PUMP UNIT

- For Handling Heavy Fuel Oils
- In Packaged Boiler and Commercial Heating Applications

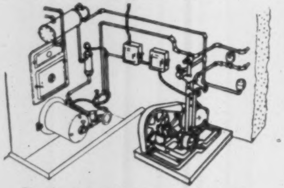


Economically priced, TUTHILL'S SU PUMP UNIT has been specifically developed for handling heavy fuel oils in commercial heating applications and with packaged boilers.

This "v" Belt Driven Unit is compact—complete units measure only 24¼" x 14⅝". Quiet operation is insured by the 2 or 4 "v" Belt Drive and the integral gear positive displacement pump design.

Construction features which provide dependable trouble-free operation, lower maintenance costs, include two ball bearing pillow blocks, one point take-up for simple adjustment of belt tension, removable belt guard and new fabricated steel base with versatile motor mounting.

SU PUMP UNITS can be furnished with a wide variety of pumps and motors for pressures up to 300 psi, capacities to 2030 gallons per hour. Sub-assemblies of pump, stub shaft, pillow block and sub-base are also furnished separately as a unit for incorporation into systems by boiler and furnace manufacturers. Write today for complete information.



Typical Application of SU Unit

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Illinois
Gentlemen:
Please forward Catalog describing Tuthill SU Pump Units.
NAME__________ COMPANY__________
TITLE__________
STREET__________
CITY__________ STATE__________

TUTHILL PUMP COMPANY
947 East 95th Street, Chicago 19, Ill.
Canadian Affiliate: Ingersoll Machine & Tool Company, Ltd., Ingersoll, Ontario, Canada

PUMPS FOR YOUR PURPOSE

WE HEAR THAT

Continued

available to technical societies, trade or technical schools, manufacturers, installation and service companies, and other interested groups. The first subject, titled "The TEV Story—Theory of Operation," covers the fundamentals of the thermostatic expansion valve. Requests for the training kit may be made through any Sporlan field engineer or direct to the company.

▶ Plans for a company-sponsored "air lift" have been announced by *FEDDERS-QUIGAN CORP.* The company intends to fly more than 7000 dealers and their wives to Nassau, Bahamas, for expense-paid, week-long "working vacations" beginning in September. To qualify, the dealer must sell a certain quota of room air conditioners during the summer.

▶ *ORR & SEMBOWER, INC.* and Consolidated Edison Co. were cosponsors of a three-day workshop on gas combustion for engineers, contractors, architects and local utilities held recently at the Con Edison classroom at Flushing, N.Y. The conference highlighted late developments in gas fired boiler equipment in connection with natural and manufactured gas as a fuel.

▶ *JAMESBURY CORP.* has moved into new, modern quarters in Worcester, Mass., the company announces. The plant provides five times more floor space than the firm previously had at its disposal and is located in a building constructed for Jamesbury's operation.

▶ *CAMBRIDGE FILTER CORP.* will spend $1,250,000 for buildings and equipment this year to expand its production capacity, said *JOHN W. LOGAN*, president. Work will begin immediately on construction of a plant addition at the present headquarter facilities in Lowell, Mass., and on equipping another plant in Lowell for heavy production and one in Nashua, N.H. The projects will bring total production area to 130,000 sq ft, with employment increasing to approximately 800 by the end of the year.

▶ *DOLE VALVE CO.* has completed its move to new administrative headquarters adjoining its manufacturing plant in Morton Grove, Ill., a suburb of Chicago. The two-story administration building is the latest of the new units to be completed on a 25 acre site. It houses the company's sales and engineering departments and research and development laboratories, as well as its executive offices.

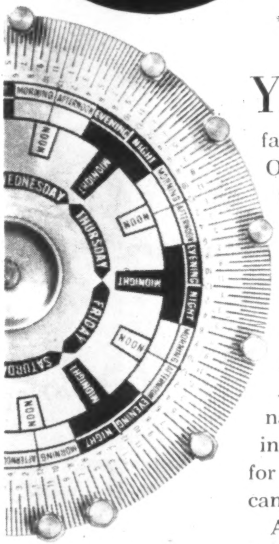
▶ Recognizing the need for better training in the science of applying, installing and servicing air conditioning equipment, *NATIONAL-U.S. RADIATOR*

All set to save on fuel bills

any day, any night, all week!

PARAGON 700 SERIES
7-DAY CALENDAR DIAL
TIME SWITCH

Turns heating equipment off when not needed

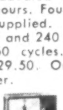


YOU can't beat the 700 series for promoting customer satisfaction through lower fuel bills! Once installed, it automatically turns heating systems ON as needed — turns them OFF during non-working-hours.

An entire week's program can be set in advance. ON-OFF can be programmed to any irregular daily schedule. Any day or days can be eliminated entirely. Monday morning ON can be earlier than usual for week-end pick up. Operations can be as close as 3 hours.

Air conditioning, ventilating, lighting, flushing, pumping and other operations can also be controlled on a weekly schedule with this 7-day time switch.

Dial is graduated into hours and half-hours. Fourteen dial trippers supplied. Available in 24, 120 and 240 volts; 25, 50 and 60 cycles. Lists as low as $29.50. Order from your jobber.



Write for information on the Paragon 2900 series to solve your off-schedule heating problems.

TODAY — Write for "Time is Money" — new Paragon handbook for you and your crews. Twenty pages of money-making ideas and handy application chart. Address Dept. 1811

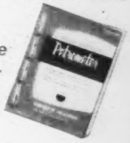
PARAGON ELECTRIC COMPANY
TWO RIVERS, WISCONSIN

Petrometer
SERIES 1400
LIQUID DEPTH GAUGES

ACCURATE and EASY TO INSTALL

Available in 4 Models, Petrometer Series 1400 Tank Gauges operate on the sound principle of hydrostatic pressure. No moving parts, no expensive electrical or electronic equipment. Large vertical scale gives accurate, easy-to-see reading. And construction features make installation easy.

For complete information send for Bulletin 6004



All Petrometer Gauges are guaranteed for one year

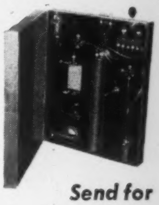
Measure Specific Gravity Accurately!

. . . and from a remote point

The Petrometer remote reading Specific Gravity Indicator is accurate to .001 Sp. G. unit, with interpolation to .0005 unit! It's easy to install . . . and operates on the simple, sound principle of a differential bubbler.

An ideal instrument for plant or laboratory for measuring specific gravity of any liquid . . . paints, fuel, resins, pharmaceuticals, chemical solutions.

All functional parts are conveniently mounted on rear of panel, accessible by swinging open the cabinet door.



Send for Bulletin 7004

Petrometer
CORPORATION
43-22 TENTH STREET, LONG ISLAND CITY 1, N.Y.

WE HEAR THAT

Continued

CORP. has organized an air conditioning school. "It will help us," comments *J. L. MORRISON*, school director, "to make our contribution towards education of the trade in the proper installation and service of air conditioning products." Curriculum is geared to teach sales and service personnel the fundamentals . . . the function of an air conditioning system and its component parts.

▶ *GREGORY INDUSTRIES, INC.* plans to spend approximately $500,000 at its *NELSON STUD WELDING DIV.* plant at Lorain, Ohio, during the coming year. The program will include building additions which will increase Nelson's available floor space by nearly 50 percent.

▶ *BLOSSOM MFG. CO.* has moved its executive, sales, purchasing, advertising and accounting offices to new quarters at 292 Fifth Ave., New York City.

▶ A new machine-system processing blower wheels for a wide range of air conditioning and heating products is now in operation at the *AIRTEMP DIV., CHRYSLER CORP.* plant in Dayton. The equipment, described by *R. J. SCHUMANN*, vice president of manufacturing, as "a new approach to automation," fabricates a blower wheel at an average rate of one every 35 sec.

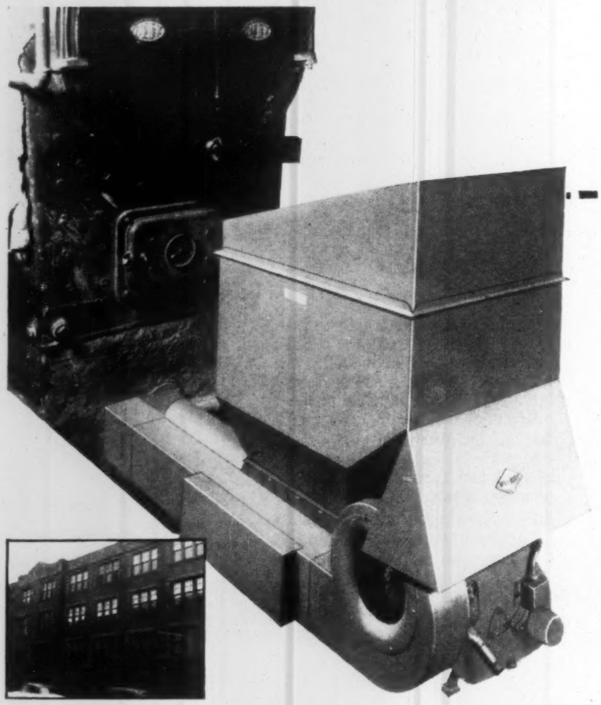
▶ Four La Crosse, Wis., and four area senior high school boys have been awarded *TRANE CO.* pre-engineering scholarships at La Crosse State College. The eight $500 scholarships are being given under a new program instituted by Trane this year.

▶ A unique valve museum, recounting the history of lubricated plug valve development, has been opened by *ROCKWELL MFG. CO.* at its Barberton, Ohio, plant. Displayed are drawings, cutaways and working models showing progress in designs and types over the last 40 years.

▶ *ANSUL CHEMICAL CO.* has relocated its Philadelphia sales office from 828 N. 29th St. to One Bala Ave., Bala Cynwyd, Pa.

▶ Continuing its expansion program for branch offices, *THOR POWER TOOL CO.* has moved its Houston office to new and larger quarters at 5503 Lawndale Ave. ‡

Performance Proves it...



the modern method to more heat per fuel dollar . . .

....fuel saving 25%!

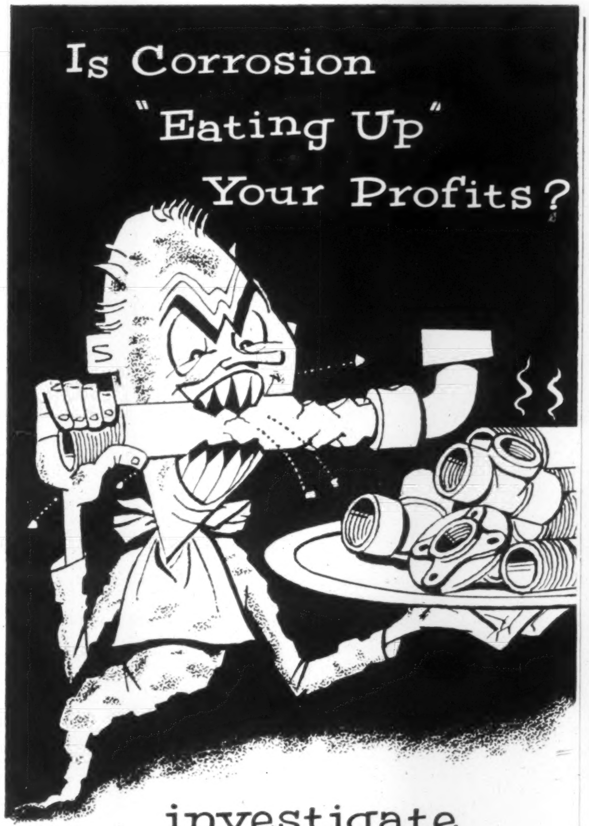
WILL-BURT
STOKERS
ORRVILLE, OHIO

This Will-Burt Hopper Stoker Model is used in a large apartment in Chicago. Installed approximately one year ago it has already produced fuel savings of 25%!

Added benefits . . more uniform temperature control, less custodian supervision.

Air Controlled WILL-BURT STOKER

Write for literature. Engineering and advisory services available.



investigate

Van-Cor

PIPE, FITTINGS, VALVES

Van-Cor is an unplasticized polyvinyl chloride that resists the corrosive action of hundreds of industrial acids and alkalis as well as sewage waste and brine. Van-Cor piping costs less, is lighter in weight, and easier to install than conventional pipe. It is readily formed, machined, threaded and welded. On many installations where metallic piping was eaten up *in a few months,* Van-Cor pipe has served *for years without deterioration.* Thus it quickly returns its cost and pays handsome dividends.

Van-Cor sheets are also fabricated into ducts, hoods, chemical tanks, fumestacks, etc.

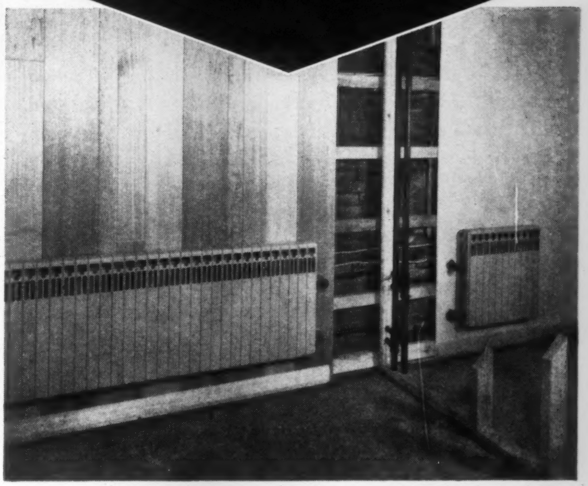
INVESTIGATE!

Write for Bulletin, Specifications and Name of Nearest Distributor.

INDUSTRIAL DIVISION OF
COLONIAL PLASTICS MFG. CO.

SUBSIDIARY OF THE VAN DORN IRON WORKS CO.
2685 EAST 79th STREET • CLEVELAND 4, OHIO

REDUCE piping costs ... SPEED installation



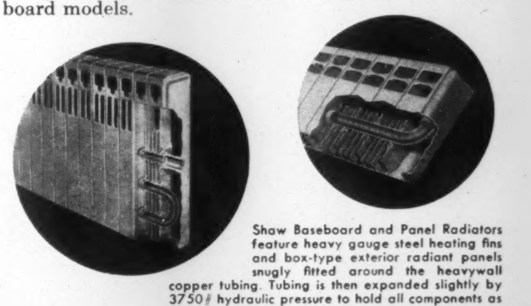
with

SHAW Radiators

Only Shaw, of all modern radiators, offers *same end* as well as opposite end tapping. Same end tapping has a place in almost every piping layout, and its use invariably means less piping materials, simplified pipe fitting.

Important savings in installation time are made with *any* Shaw model, regardless of tapping arrangement. Shaw units are compact, fully self-contained assemblies only 3" thick, easy to handle and mount. There are no dampers, or separate housings to fit and install.

Shaw Radiators distribute both radiant and convected heat in unvarying, health-guarding proportions that create natural thermal comfort in a room. They use either hot water or steam up to 150 psi. Write today for free literature on both panel and baseboard models.



Shaw Baseboard and Panel Radiators feature heavy gauge steel heating fins and box-type exterior radiant panels snugly fitted around the heavywall copper tubing. Tubing is then expanded slightly by 3750# hydraulic pressure to hold all components as a rigid, self-contained unit. The tight metal-to-metal bond assures rigidity and full heat conduction.

SHAW-PERKINS
MANUFACTURING COMPANY
201 East Carson St. • Pittsburgh 19, Pa.

MEETINGS & CONVENTIONS

1957

AUG. 11-15—*First National Conference on Applied Heat Transfer.* Pennsylvania State University, University Park, Pa. Sponsored by heat transfer division and central Pennsylvania section of American Society of Mechanical Engineers in cooperation with College of Engineering and Architecture of the University. ASME headquarters: 29 W. 39th St., New York 18.

AUG. 26-28—*Gas Dynamics Symposium.* Technological Institute, Northwestern University, Evanston, Ill. Information: Dr. Ali Bulent Cambel, Gas Dynamics Laboratory, Northwestern University, Evanston, Ill.

SEPT. 9-13—*12th Annual Instrument Automation Conference and Exhibit.* Cleveland Auditorium, Cleveland. Sponsored by Instrument Society of America, 313 Sixth Ave., Pittsburgh 22. Exhibit information: Fred J. Tabery, 3443 S. Hill St., Los Angeles.

SEPT. 13-14—*Associated Insulation Contractors of the Western States,* 16th annual meeting. El Coronado Hotel, San Diego. Information: Insulation Distributor-Contractors National Association, Inc., 1632 K St., N.W., Washington, D.C.

SEPT. 17-20—*Insulation Distributor-Contractors National Association, Inc.,* second annual convention. St. Francis Hotel, San Francisco. Information: IDCNA, 1632 K St., N. W., Washington, D. C.

OCT. 1-4—*National Association of Corrosion Engineers,* north central regional meeting. Chicago. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 1-4—*National Association of Corrosion Engineers,* south central regional meeting. Oklahoma City. NACE headquarters: 1061 M & M Bldg., Houston 2.

OCT. 6-8—*Fluid Control Institute.* Westchester Country Club, Rye, N. Y. Information, Fluid Control Institute, Inc., P. O. Box 191, Decatur, Ill.

OCT. 7-9—*American Gas Association,* annual convention. Kiel Auditorium, St. Louis. AGA headquarters: 420 Lexington Ave., New York 17.

OCT. 21-25—*45th National Safety Congress & Exposition.* Conrad Hilton Hotel, Chicago. National Safety Council, 425 N. Michigan Ave., Chicago 11.

Write for new Bulletin!

WILSON
CENTRIFUGAL BLOWDOWN
SEPARATOR

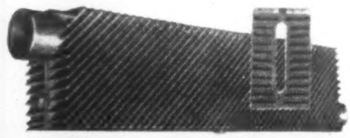
SOLVES BOILER BLOWDOWN DISPOSAL PROBLEMS

Here is the safe, economical way to handle boiler blowdown . . . at atmospheric pressure. Steam flash is instantaneously cleared through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectionable noise. Install where convenient, inside or out—even on boiler room roof. One Wilson Separator can handle two or more boilers in battery, if desired. Special models with flanged or butt welding connections available.

- MEETS REQUIREMENTS OF A.S.M.E. UNFIRED PRESSURE VESSEL CODE
- SIMPLE TO INSTALL
- REQUIRES NO MAINTENANCE
- THOUSANDS IN SERVICE

WILSON ALL-CAST ALUMINUM RADIATION ELEMENTS

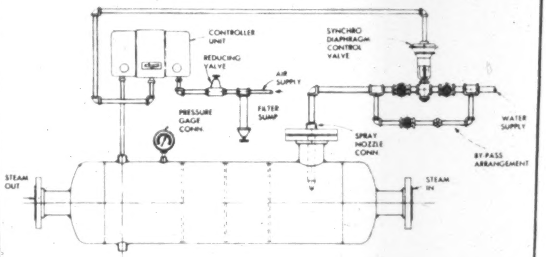
. . . provide maximum heat transfer with minimum weight. Rugged construction with high resistance to corrosion or electrolytic deterioration. You gain these advantages in Wilson Aftercoolers, Unit Heaters and other radiation products.



WILSON ENGINEERING CORPORATION

6 North Michigan Avenue Dept. H-7 Chicago 2, Illinois

For effective evaporation type desuperheating Specify WHITLOCK



This efficient "package" desuperheats steam and permits use of low pressure, economical equipment. Operating on the evaporation principle of heat removal, the Whitlock Evaporation Type Desuperheater offers these outstanding features:

- **Dependability over relatively great ranges of steam flow and steam temperatures.**
- **Total or partial desuperheating, as may be required.**
- **Positive action to preclude "flooding" of the desuperheater.**
- **A.S.M.E. Code design, construction, and stamping.**

Ask for Bulletin 150. We will gladly assist you with cooling or heating problems.

THE WHITLOCK MANUFACTURING CO.
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Richmond • Authorized representatives in other principal cities.
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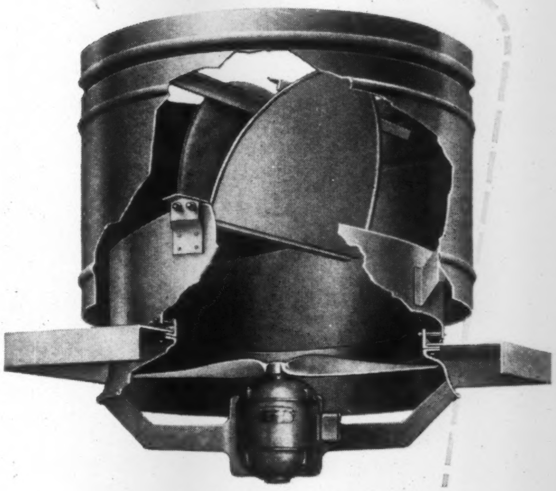
Whitlock

Designers and builders of bends, coils, condensers, coolers, heat exchangers, heaters, piping, pressure vessels, receivers, reboilers

SKY-BLAST®

moves more air at less cost



...powerful roof ventilator with
***NEW** Smoke-Trip® Damper Opener*

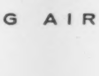
Because Propellair Sky Blast roof ventilators do not need the usual restricting weather cover which deflects and reduces air movement, they move more air at less cost. Fumes and heat are thrown high into the air, can't re-enter windows or turn downward to create roof maintenance problems. Their efficiency is not effected by wind velocity or direction. Weatherproof dampers open automatically when fan is started. Hot-dip galvanized after fabrication, Propellair Sky Blast ventilators are ruggedly built to give years of maintenance-free service. Available in sizes from 16" to 60" for 2820 to 78,800 CFM—PFMA Certified Ratings.
If desired, exclusive new Smoke-Trip heat-actuated venting device which automatically opens dampers in case of fire to exhaust smoke and fumes is available.

WRITE FOR BULLETIN NO. 680-HP

R&M **PROPELLAIR**®
DIV. OF ROBBINS AND MYERS, INC.
SPRINGFIELD, OHIO

Certified Ratings
PFMA

MAN COOLER



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MOVING AIR IS OUR BUSINESS

MEASURE

ACTUAL
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VELOMETER

A simple, direct reading on the Alnor Velometer gives you instant measurement of actual air delivery in any distribution system. This fast, precise method eliminates the time and money wasted in trial-and-error balancing...the profit-eating call-backs so often necessary with other less precise measurements.

The Velometer is the only instantaneous, direct reading air velocity meter—accurate in all ranges, from high to low... compact, portable, easy to understand and use. Wide assortment of jets and fittings makes this precision instrument ideally suited for all air velocity measurement.

First Choice of Industry

Take the recommendation of every major manufacturer of air diffusers and leading contractors—get an Alnor Velometer. You'll save time and money on the next installation you balance.

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FOR EVERY INDUSTRY

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Please send Velometer Bulletin 2448-G.

Name..........

Company..........

Address..........

City..........Zone......State..........

MEETINGS & CONVENTIONS

Continued

1957

OCT. 22-24—National Association of Corrosion Engineers, seventh annual western regional conference, San Diego. Information: NACE, 1061 M & M Bldg., Houston 2.

OCT. 31-NOV. 2—Western Society of Engineers, national conference, Edgewater Beach Hotel, Chicago. Sponsored by Engineers Joint Council, Scientific Manpower Commission, National Science Foundation and National Academy of Sciences—National Research Council. Information: Engineers Joint Council, 29 W. 39th St., New York 18.

NOV. 12-14—National Association of Corrosion Engineers, northeast regional meeting, Pittsburgh. NACE headquarters: 1061 M & M Bldg., Houston 2.

NOV. 13-14—Air Pollution Conference, Chicago. Cosponsored by Armour Research Foundation and Midwestern Air Pollution Prevention Association. Information: Conference secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16.

NOV. 14-16—American Society of Refrigerating Engineers, semi-annual meeting, Chicago. ASRE headquarters: 234 Fifth Ave., New York.

NOV. 16-18—Refrigeration and Air Conditioning Contractors National Association, annual convention. Drake Hotel, Chicago. The association is at 10660 Carnegie Ave., Cleveland 6.

NOV. 16-18—Air-Conditioning and Refrigeration Wholesalers, annual meeting. Sheraton Hotel, Chicago. Information: 2607 N. High St., Columbus, Ohio.

NOV. 18-21—10th Exposition of the Air-Conditioning and Refrigeration Industry, International Amphitheater, Chicago. Air-Conditioning and Refrig-

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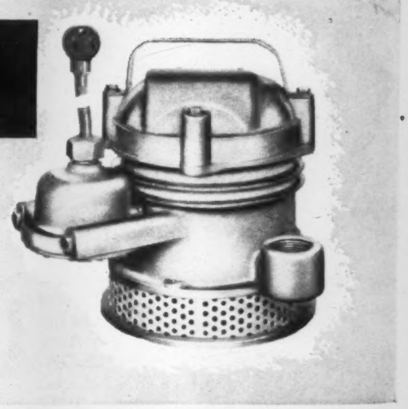
A new postal regulation relating to the handling of undelivered mail may result in some issues of *Heating, Piping & Air Conditioning* being thrown away instead of being returned to us — as they have been in the past — for remailing to your new or correct address.

To avoid missing any issue of *Heating, Piping & Air Conditioning* it is more important than ever to report both your new and old address to us and your post office. Deadline is the 8th of the preceding month for the next issue. Send changes — and new local postal delivery zone — to

HEATING, PIPING & AIR CONDITIONING
6 N. Michigan Ave., CHICAGO 2, ILL.



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SUBMERSIBLE

SUMP PUMP

A PACKAGED UNIT . . . priced lower than many conventional Sump Pumps

OPERATES UNDER WATER ●
Hermetically sealed motor with a leak-proof rotating shaft seal assures dependable performance at all times.

FOR FLOOD-PROOF OPERATION ●
If current fails moisture cannot damage pump or motor.

FOR ECONOMICAL INSTALLATION ●
Is easily installed in a metal tile or concrete sump 2′ to 8′ deep.

FOR GAS-TITE INSTALLATIONS ●

FOR SMALL SUMPS ●
Can be installed thru a 15″ opening.

Built for – **Automatic Submerged Operation**

CONTROLS

NEW
PRESSURE
SWITCH
MODEL SS-800
ILLUSTRATED

PRESSURE SWITCH
Fool-proof and trouble-free.
ELECTRODE
For special installations.
FLOAT SWITCH
For Duplex Units.

MOTOR: 1/3 HP, 1750 RPM, 110 volt **CAPACITOR TYPE** with 8 ft. waterproof cable and plug
IMPELLER: Bronze
SCREEN: Brass
BASE: Sturdy cast-iron
DISCHARGE: 1¼″
SHAFT: Stainless steel
DIMENSIONS: Height: 11″; Diameter: 11¾″; Weight: 50 lbs.

Engineered for One Million Starts

weil PUMP CO.

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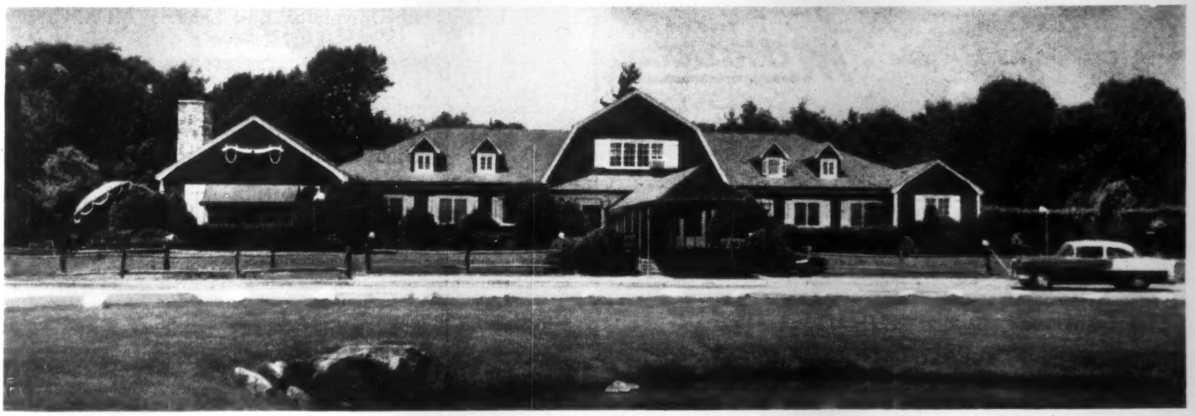


How Spraco roof cooling systems

KEEP BUILDINGS 10-20° COOLER . . . SAVE 25% ON AIR CONDITIONING COSTS!

You can keep your plant 10–20° cooler with a SPRACO roof cooling system — without the expense of air conditioning.

Even if you now have an air conditioning system, you can cut its operating cost *up to 25%* by combining it with roof cooling. Thus, SPRACO helps you save either way.

As a major manufacturer of special nozzles, SPRACO offers a complete line of roof cooling nozzles for both *flat and pitched* roofs . . . nozzles carefully designed and engineered for economical, trouble-free operation in automatic or operator-controlled systems.

To find out how SPRACO can cut your cooling costs, write or phone today. We'll send a cooling systems engineer to make a complete survey of your plant. No obligation, of course.

FREE — *Up-to-the-minute brochure plus installation print covering Spraco roof cooling nozzles.*

SPRACO NOZZLES

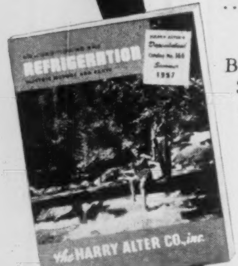
SPRAY
ENGINEERING COMPANY
135 Central Street,
Somerville 45, Mass.

AIR CONDITIONING is our SPECIALTY

Refrigeration and Electric Motors, Too!

OVER 10,000 ITEMS... the world's most comprehensive listing of parts and supplies ... appear in the Harry Alter DEPENDABOOK No. 166 Summer, 1957 complete with illustrations, descriptions, prices and other useful information.

PARTS and Supplies



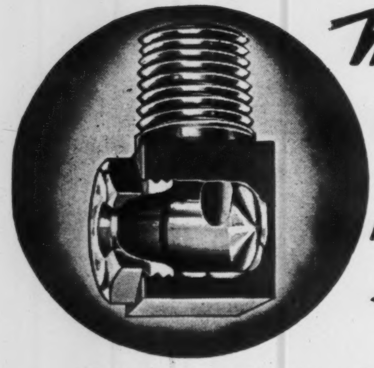
SAVE MONEY, time and effort by ordering the parts you need from this compact, easy-to-read, up-to-date catalog.

Write on your letterhead for the DEPENDABOOK

WHOLESALE ONLY

The HARRY ALTER CO., Inc.
1717 S. Wabash Ave., Dept. H, Chicago 16, Ill.
or visit branches 134 Lafayette St. New York 13, N.Y. 122 Parkhouse St. Dallas 7, Texas Bldg. B, Unit 8 690 Stewart Ave., S.W. Atlanta 10, Ga.

Monarch NOZZLES for AIR WASHERS



These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.

Standard material Brass. Also available in Stainless Steel and Monel. Pipe sizes from 1/8" to 1". 1/4" size is 1-5/16" long and made from 5/8" square stock.

Write for Catalog I

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2523 E. ONTARIO ST.
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Canadian Agents (Except B. C.)
E. S. Gallagher Sales Ltd. Toronto 12, Canada

MEETINGS & CONVENTIONS

Continued

1957

eration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

NOV. 18-22—*National Warm Air Heating and Air Conditioning Association*, committee meetings and annual convention. Morrison Hotel, Chicago. NWAHACA headquarters: 640 Engineers Bldg., Cleveland 14.

1958

JAN. 27-29—*American Society of Heating and Air-Conditioning Engineers, Inc.*, 64th annual meeting. Pittsburgh. Information: A. V. Hutchinson, executive secretary, ASHAE, 62 Worth St., New York 13.

JAN. 27-30—1958 *Plant Maintenance and Engineering Show*. International Amphitheater, Chicago. Management: Clapp & Poliak, Inc., 341 Madison Ave., New York 17.

FEB. 17-20—*Seventh Annual Industrial Ventilation Conference*. Kellogg Center, Michigan State University, East Lansing, Mich. Information: Industrial Ventilation Conference, Continuing Education Service, Michigan State University, East Lansing, Mich.

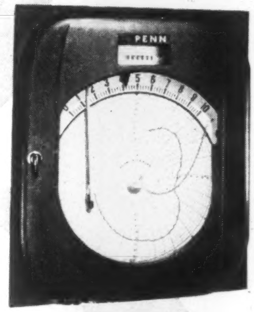
MARCH 17-21—*National Association of Corrosion Engineers*, annual conference and exposition. Civic Auditorium, San Francisco. NACE headquarters: 1061 M & M Bldg., Houston 2.

MARCH 31-*APRIL* 2—*Gas Appliance Manufacturer's Association*, annual meeting. The Greenbrier, White Sulphur Springs, W.Va. GAMA headquarters: 60 E. 42nd St., New York 17.

MAY 4-7—*Air-Conditioning and Refrigeration Institute*, annual meeting. The Homestead, Hot Springs, Va. ARI headquarters: 1346 Connecticut Ave., N.W., Washington 6, D.C.

JUNE 9-13—*Fourth International Automation Exposition* and *International Automation Congress*. Coliseum, New York. Information: Richard Rimbach Assoc., 845 Ridge Ave., Pittsburgh 12.

JUNE 23-25—*American Society of Heating and Air-Conditioning Engineers, Inc.* and *American Society of Refrigerating Engineers*, joint meeting. Hotel Leamington, Minneapolis. ASHAE headquarters: 62 Worth St., New York 13. ASRE headquarters: 234 Fifth Ave., New York 1. ✣



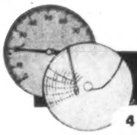
When it's B/M "Matched Metering"

—you know it's accurate!

The high fidelity of Burgess-Manning Electric and Electronic Meters is made possible only by the Burgess-Manning null-balance inductance bridge, servo-powered meter principle employed. To this has been added the refinement of a calibrated cam, which matches the calibration of the recorder-totalizer and the differential producer for perfection thru "Matched Metering." Burgess - Manning electric transmission is suitable for distances up to 5000 feet. You'll never regret having specified Burgess-Manning "Matched Metering" for greatest overall accuracy.

Burgess-Manning Meters are also available in mechanical types.

Request Catalog 800



BURGESS-MANNING COMPANY
PENN INSTRUMENTS DIVISION
4108 Haverford Ave., Philadelphia 4, Pennsylvania

Instrumentation and Controls for water, steam, gases, sewage and industrial wastes

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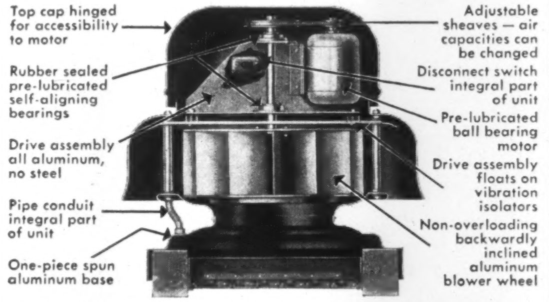
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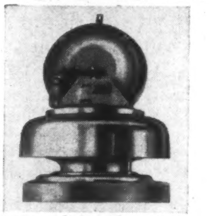

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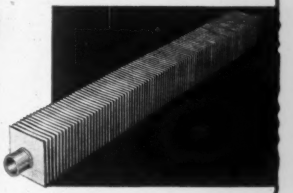

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PROPERTIES OF COMMONLY USED REFRIGERANTS—Revised Ed. 136 pp. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D.C. $2.00.

1956 PROCEEDINGS OF THE NATIONAL DISTRICT HEATING ASSOCIATION—173 pp. National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6. $7.50.

SPECIFICATIONS WORKSHOP OF THE BUILDING RESEARCH INSTITUTE—28 pp. Building Research Institute, Div. of Engineering and Industrial Research, National Academy of Sciences—National Research Council, 2101 Constitution Ave., Washington 25, D.C. $2.00.

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TESTING AND RATING CODE FOR BASEBOARD RADIATION—Third Ed. Institute of Boiler and Radiator Manufacturers, 608 Fifth Ave., New York 20.

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MANUAL ON INDUSTRIAL WATER—ASTM special technical publication 148-B. 502 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $6.00.

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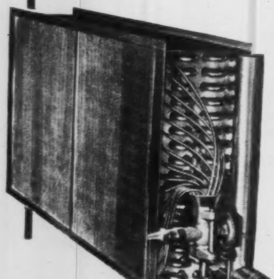

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Flexible Polyethylene Plastic Pipe—Second Ed. Commercial standard CS 197-57. Superintendent of Documents, Government Printing Office, U.S. Department of Commerce, Washington 25, D.C. 10c.

Proceedings of the American Power Conference, 18th annual meeting—665 pp. Illinois Institute of Technology, Technology Center, Chicago 16. $8.00.

Symposium on pH Measurement—ASTM special technical publication 190. 104 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $2.50.

Investigation of Performance of Automatic Storage Type Gas and Electric Water Heaters—By E. F. Hebrank. Bulletin 436, Engineering Experiment Station, University of Illinois, Urbana. 60c.

Windows and Glass in the Exterior of Buildings—Publication NAS 478. 176 pp. Publications Office, National Academy of Sciences, 2101 Constitution Ave., Washington 25, D. C. $5.00.

The Procedure Handbook of Arc Welding Design and Practice—11th Ed. 1300 pp. Lincoln Electric Co., Cleveland 17. $3.00.

Report on Elevated-Temperature Properties of Wrought Medium-Carbon Alloy Steels—ASTM special technical publication 199. 127 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $4.25.

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The Military Application of Evaporative Cooling—By R. F. Law and W. R. Nehlsen, U.S. Naval Civil Engineering Research and Evaluation Laboratory. 29 pp. Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D.C. 75c.

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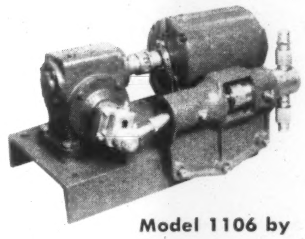

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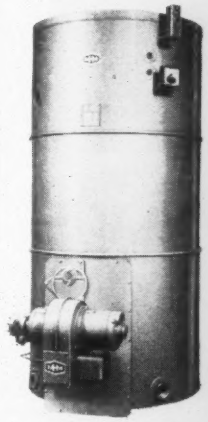

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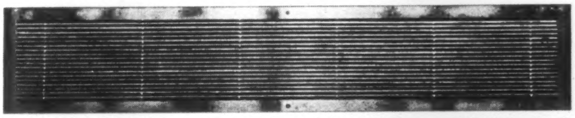

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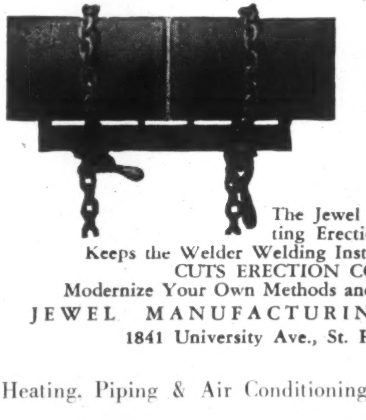

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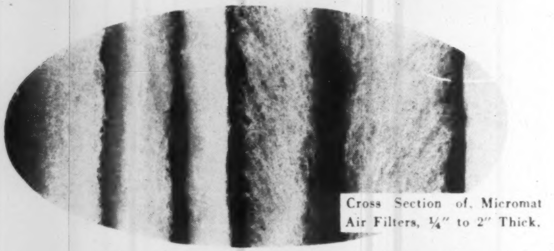

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ACTIVITIES AND PURPOSES OF THE AIR MOVING AND CONDITIONING ASSOCIATION—12 pp. Air Moving and Conditioning Association, 2159 Guardian Bldg., Detroit 26. Free.

THE CLIMATE NEAR THE GROUND—Revised Ed. By Dr. Rudolf Geiger, professor of meteorology, University of Munich. Harvard University Press, Cambridge 38, Mass. $6.00.

CLIMATIC EXTREMES FOR MILITARY EQUIPMENT—N. Sissenwine and A. Court, Office of the Quartermaster General, Department of the Army. 70 pp. Report number PB 121741, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. $1.75.

DEVICES FOR DAMPING MECHANICAL VIBRATIONS, A BIBLIOGRAPHY—Prepared by U. S. Naval Research Laboratory. 101 pp. Publication number PB 121299, Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. $2.75.

SYMPOSIUM ON SOLDER—ASTM special technical publication 189. 190 pp. American Society for Testing Materials, 1916 Race St., Philadelphia 3. $3.00.

SYMPOSIUM ON FIRE EXTINGUISHMENT RESEARCH AND ENGINEERING—512 pp. U.S. Naval Civil Engineering and Evaluation Laboratory. Copies from Office of Technical Services, U.S. Dept. of Commerce, Washington 25, D. C. $8.50. ⧺

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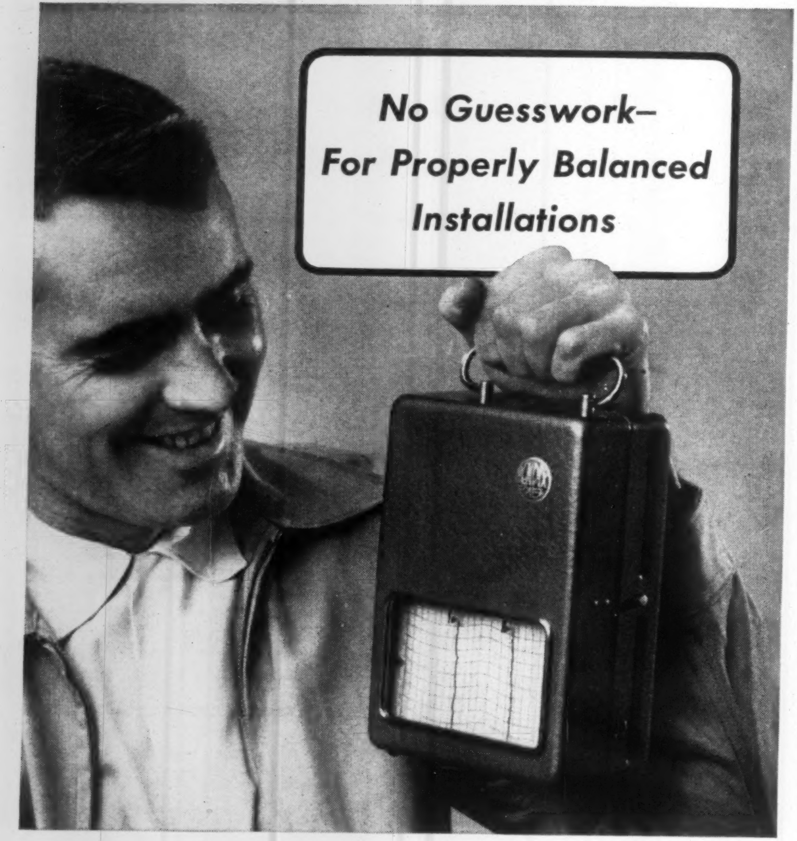

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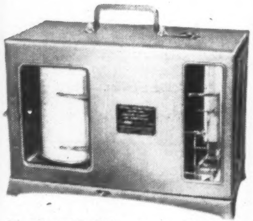

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Friez Instrument Division

Bendix
AVIATION CORPORATION

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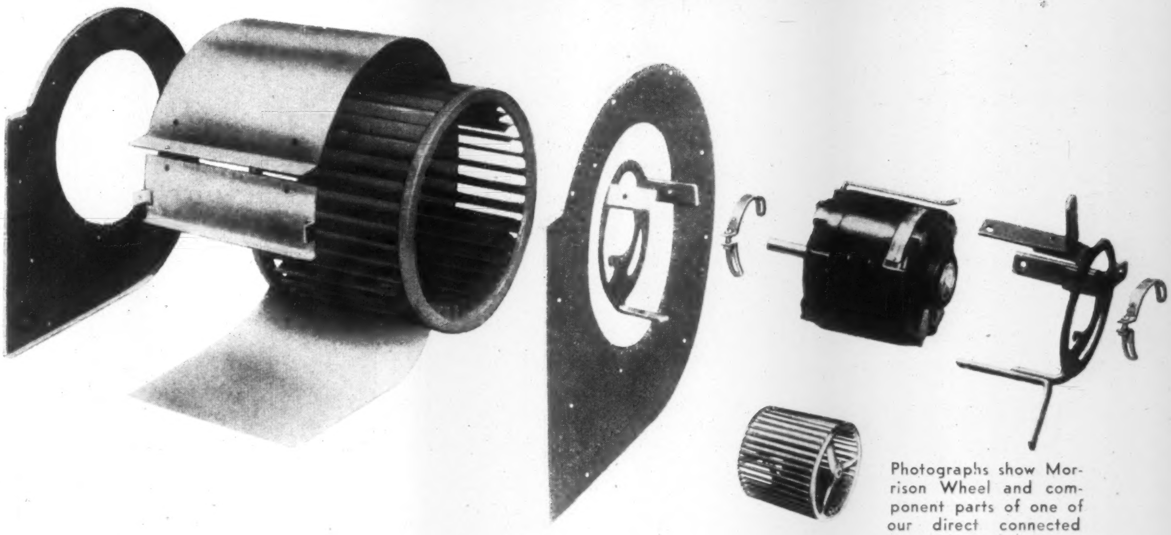

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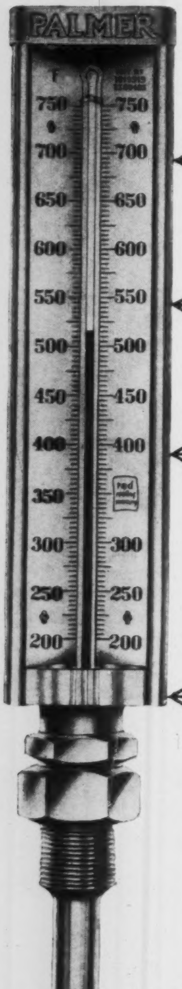

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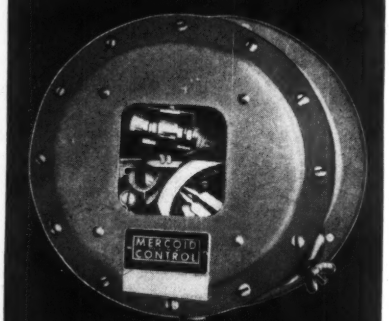

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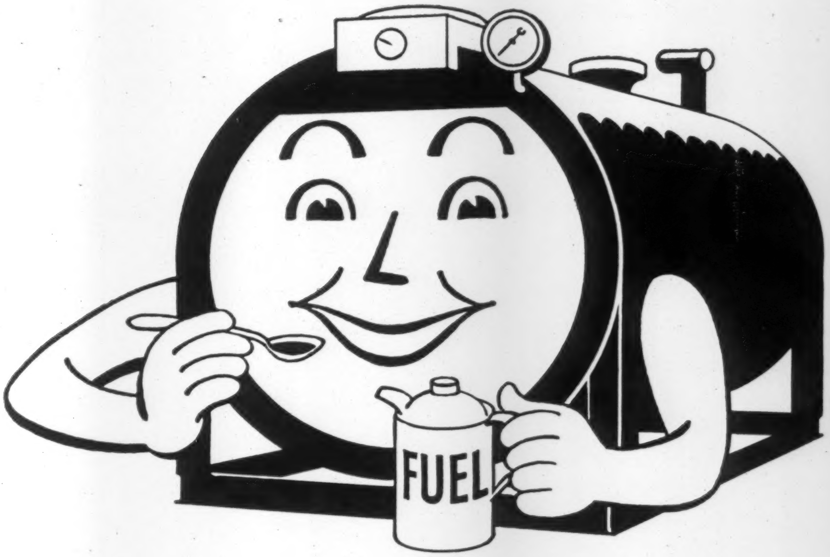

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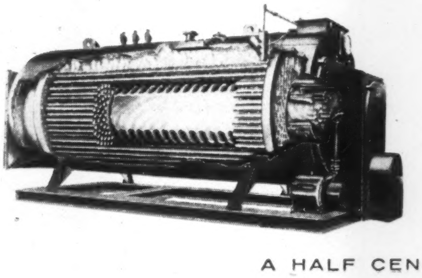

(Left) Series F Continental Automatic Boiler, with modulating control. Other models from 20 to 500 hp, with on-off or modulating controls, burn oil and/or gas. For steam heating or process work at pressures from 15 to 250 pounds, or for hot water heating at low or high temperatures.

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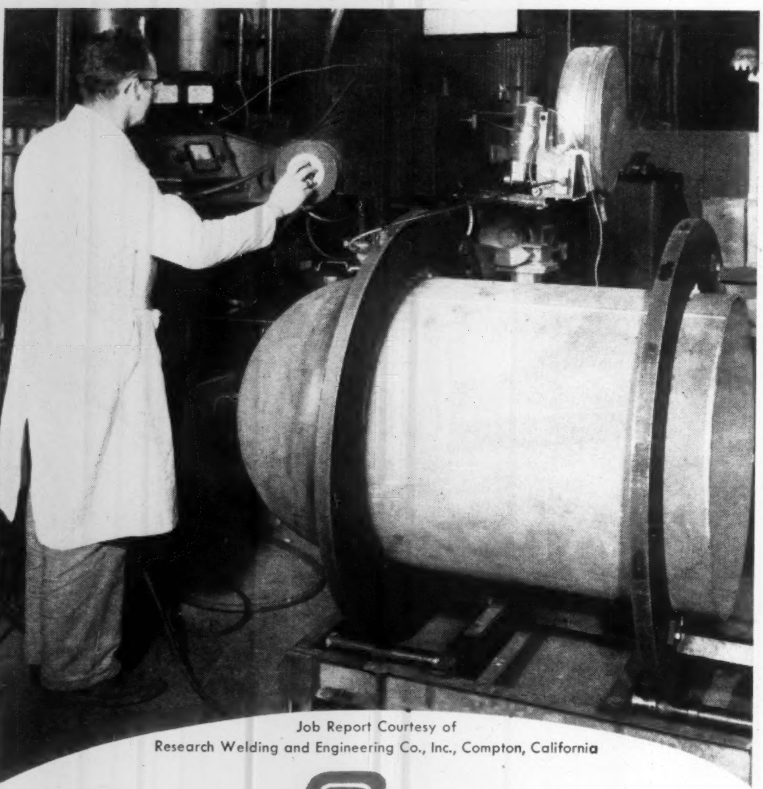

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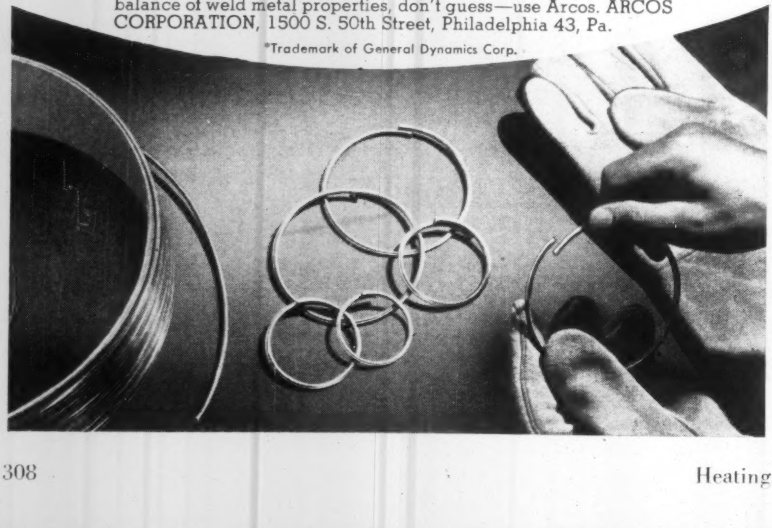

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"from Chicago"

THE 'INSIDE' STORY IS IMPORTANT TOO!

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NEW YORK, NEW YORK

ARCHITECTS: Harrison-Abramovitz and John B. Peterkin • GENERAL CONTRACTOR: Turner Construction Company, New York, New York • PLUMBING CONTRACTOR: Eugene Duklauer, Inc., 215 E. 38 Street, New York, New York • MECHANICAL ENGINEERS: Jaros, Baum and Bolles, 415 Lexington Avenue, New York, New York • PHOTO: Wurts Brothers, 15 East 40th Street, New York, New York

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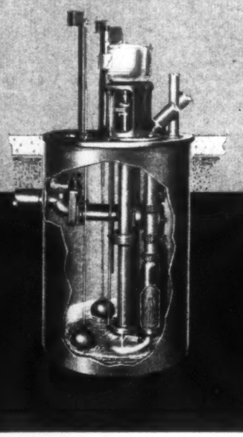

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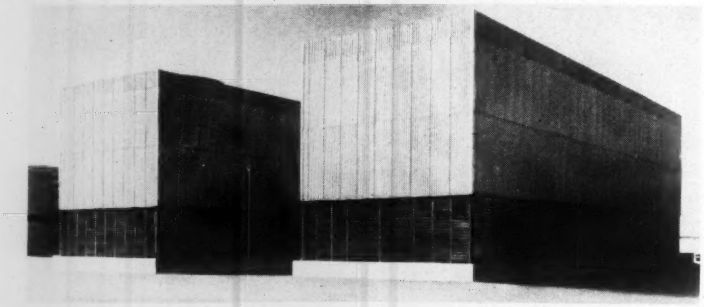
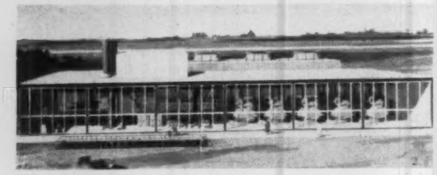


Pictured above is the largest cooling tower ever installed in New York on the world's largest absorption air conditioning system



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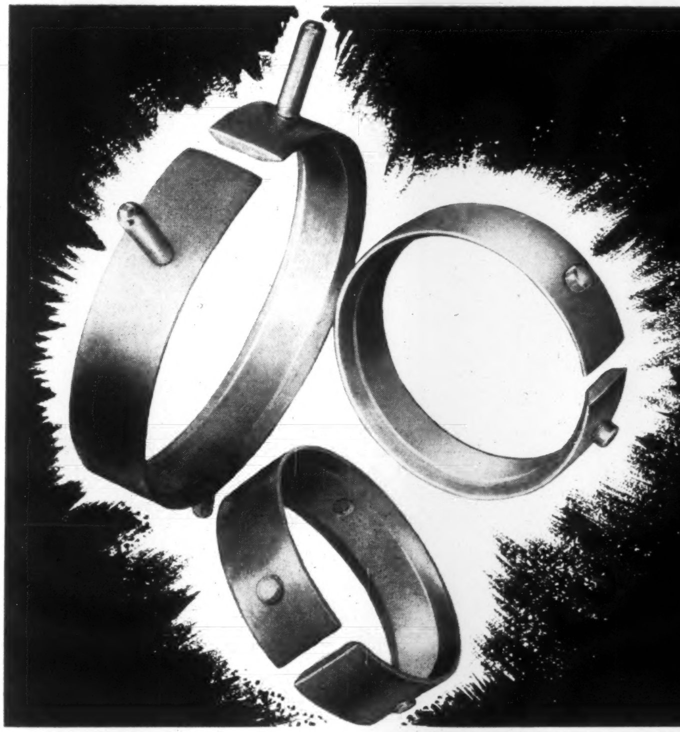

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TYPE CCC Designed for quick easy alignment of pipe where the variation in inside diameters is relatively great. Chamfered NUBS allow close tolerance fit-up and CLEAN STRIKE OFF. The ROBVON NUB conforms to the diameter of weld rod. ROBVON rings are beveled to assure non-restricted fluid flow.

TYPE CC Designed to allow quick easy alignment of pipe where the inside diameters are slightly out of round. The welder has the choice of "STRIKING OFF" the NUBS or leaving them intact to be melted into the weld mass of the first root pass.

TYPE C Designed for precise close tolerance fit-up. Type "C" NUBS conform to the diameter of the weld root. The NUBS melt with the metal to give complete penetration and fusion.

Robvon also manufactures machined rings to customer's specifications
All fabricated solid machined rings x-rayed. Write for full information

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BACKING RING COMPANY

675 GARDEN STREET ELIZABETH, NEW JERSEY

For FIRST SECURITY . . . The security of *steel pipe* heating *and* cooling!

FIRST
SECURITY

Salt Lake City's new First Security Building is ultra-modern in more than just appearance. It features dual zone air conditioning in which *steel pipe* serves for the steam, chilled water and condenser water lines throughout the 12-floor *heating and cooling* system. Nearly a mile of steel pipe—40,000 pounds—from the basement boiler and chiller installation to the penthouse condensers was required.

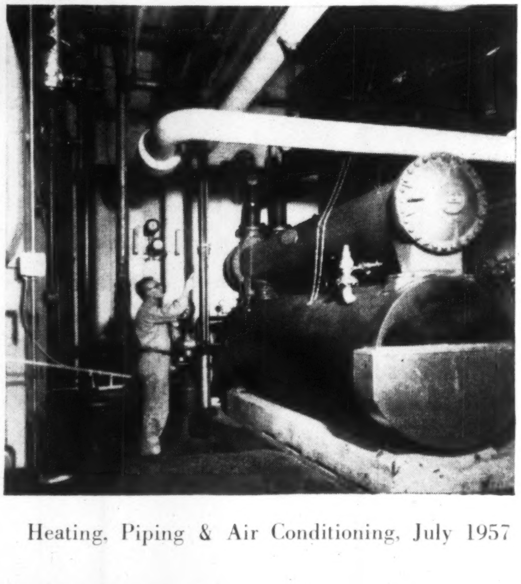
Steel pipe is first choice for wet heating . . . proved in almost 70 years of hot water and steam heating applications. Its extended use in modern dual systems for *cooling* as well as heating results, logically, from that acknowledged superiority.

Yes, for heating and cooling, snow melting, fire sprinkler systems, plumbing, power, steam and air lines, irrigation, and structural purposes, it is the most widely used pipe in the world!

Only Steel Pipe gives all these advantages!

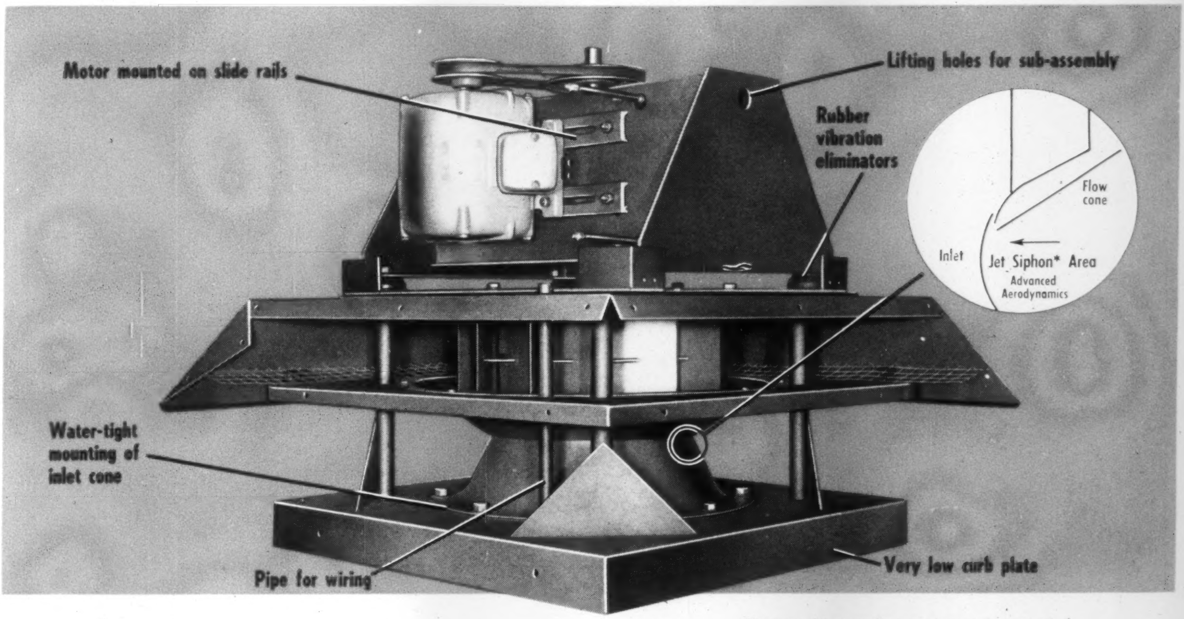
- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

Steam boiler and water chiller equipment for the dual zone air conditioner are compactly housed among this maze of steel piping.



Steel Pipe is First Choice

Committee on
STEEL PIPE RESEARCH
AMERICAN IRON AND STEEL INSTITUTE
150 East Forty-Second Street, New York 17, N. Y.


Motor mounted on slide rails
Lifting holes for sub-assembly
Rubber vibration eliminators
Flow cone
Inlet
Jet Siphon* Area
Advanced Aerodynamics
Water-tight mounting of inlet cone
Pipe for wiring
Very low curb plate

Shown with weather enclosure removed

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POWER ROOF VENTILATOR — CENTRIFUGAL TYPE

Jet Siphon* feature for stable, high efficiency.

Static pressures to 2″ — thus well suited to both light-duty installations without ductwork and applications where ductwork or hoods impose considerable resistance.

Adaptable to a wide range of motor sizes.

Variable pitch V-belt drive.

Wheel and inlet designed for streamlined air flow.

Built heavy-duty throughout to assure long-lasting, trouble-free service.

Every wheel statically and dynamically balanced on precision machines.

Inspection panel and complete accessibility.

Low overall height.

Venting of motor and drive area.

Engineered and constructed for extra quietness.

Heavy-duty anti-friction bearings.

Simple installation — only 4 bolts required.

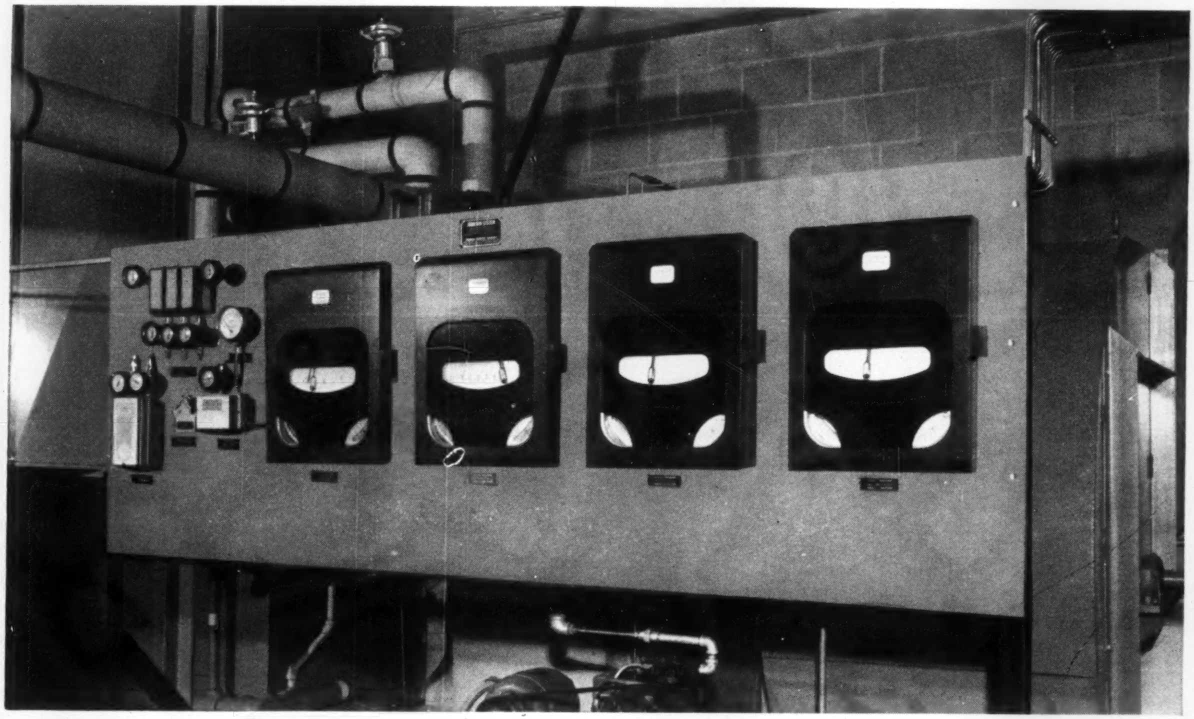
Write today for Bulletin 550. Clarage Fan Co., Kalamazoo, Mich.

*Patent applied for

CLARAGE

. . . dependable equipment for making air your servant

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal



Panel mounted Indicator-Controllers for ventilation system maintains safe room pressures in laboratories. Performance can be checked at a glance.

JOHNSON PNEUMATIC TEMPERATURE CONTROL MAKES LAB WORK SAFER, ADDS TO COMFORT

Experiments involving the use of strong acids and other hazardous materials are performed in the main laboratory rooms at the Kennecott Research Center. One of the special control problems is to heat and ventilate the laboratories without allowing unsafe air to flow to other rooms in the building.

Johnson Differential Pressure Controllers, applied to the central fan ventilation system and the exhaust fans, maintain a constant differential between the air pressures in each of the three main laboratories and the other areas of the building. These highly accurate controllers provide immediate response to the slightest change in the controlled variables, insuring maximum safety for the center's personnel and valuable equipment.

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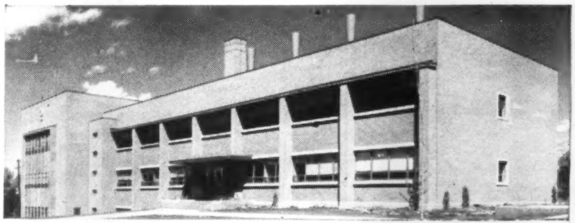

Research Center, Kennecott Copper Corporation, Salt Lake City, Utah. Ashton, Evans & Brazier, architects; A. A. Maycock, mechanical engineers; James Plumbing & Heating Co., mechanical contractor; all of Salt Lake City.

JOHNSON CONTROL

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